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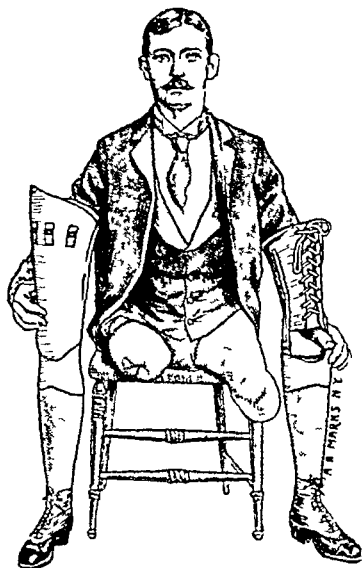
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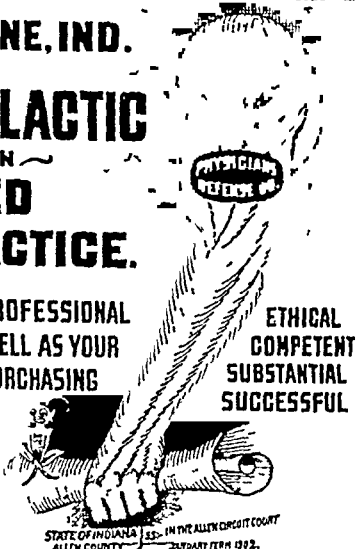
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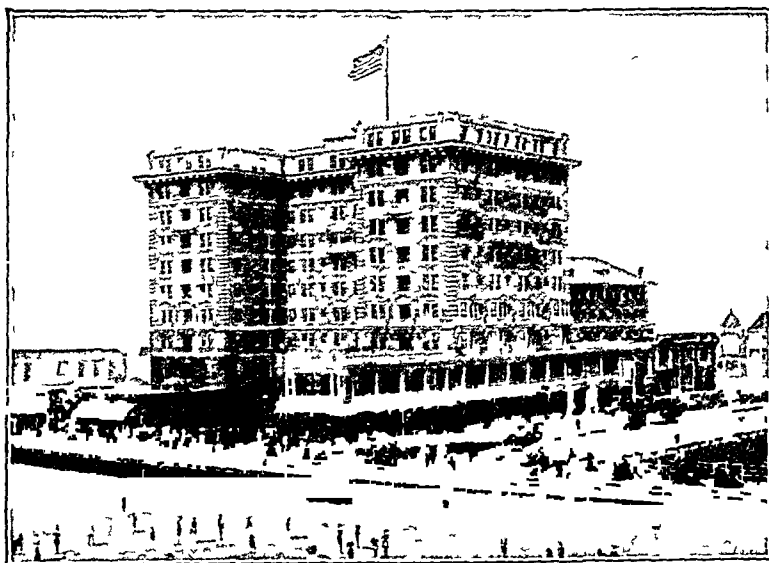
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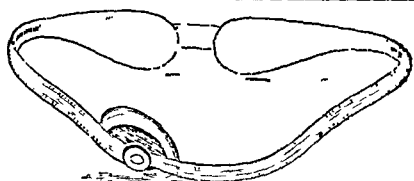
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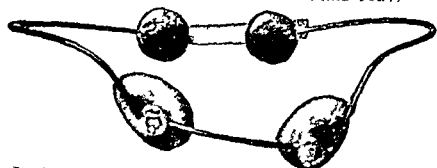
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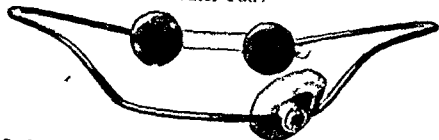
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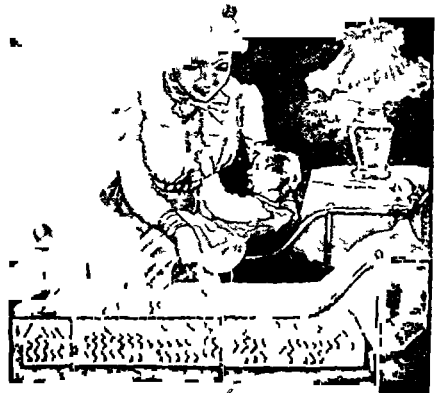


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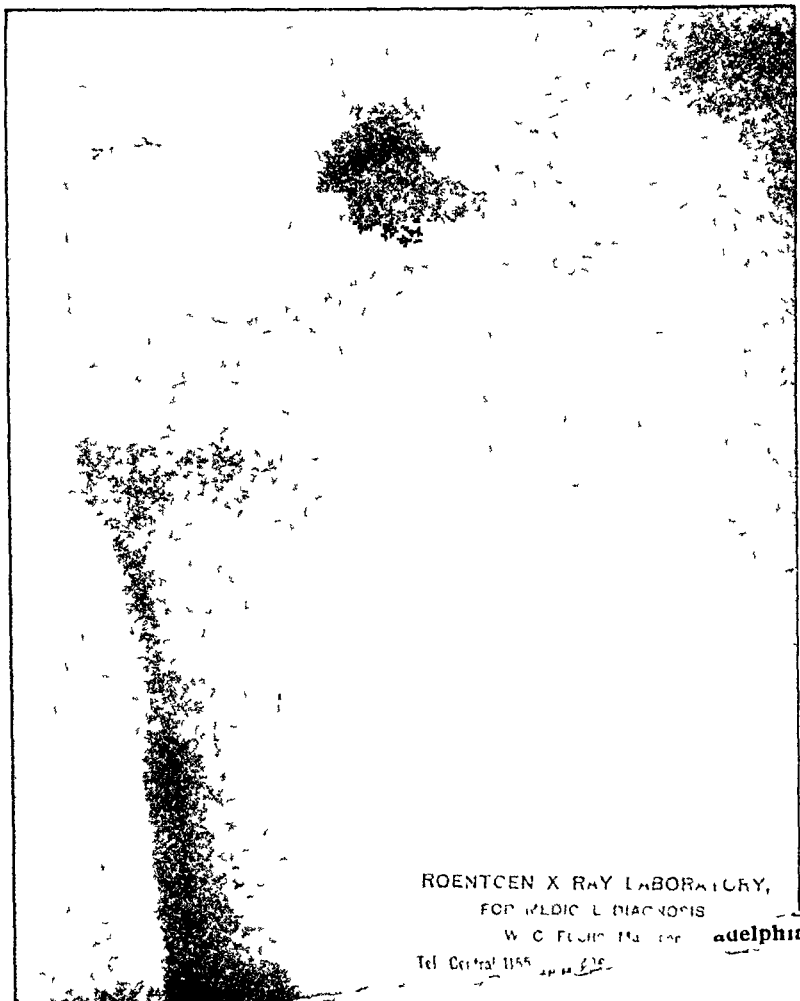
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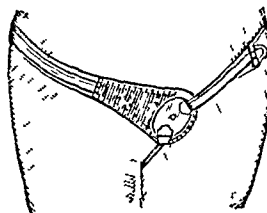
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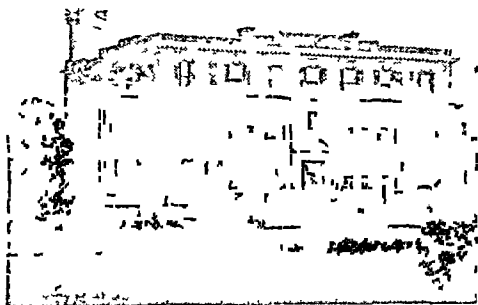


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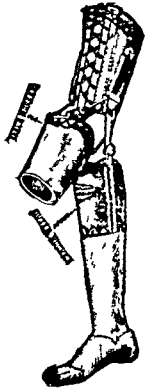
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# ANNALS OF SURGERY

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## ORIGINAL MEMOIRS.

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### FRACTURE OF THE SPINE.<sup>1</sup>

A SUMMARY OF ALL THE CASES (244) WHICH WERE TREATED  
AT THE BOSTON CITY HOSPITAL FROM 1864 TO 1905

BY HERBERT L BURRELL, M D,

OF BOSTON, MASS,

Surgeon to the Boston City Hospital, Assistant Professor of Surgery in Harvard University

*Is the spinal cord irremediably damaged?* This is the question that immediately arises in the mind of a surgeon when he first sees a patient with a fracture of the spine. The utter hopelessness of the condition, when there is complete destruction of the cord, is universally accepted.

*Can we tell whether a spinal cord is irremediably damaged or not?* On the answer to this question depends in many cases whether or not an operation should be done.

In many cases it is perfectly clear that the cord is crushed. In other cases doubt exists as to whether the cord is irremediably damaged. In still other cases it is a fair presumption that the cord is not hopelessly damaged.

These questions are constantly presenting themselves to surgeons, and it is often impossible to answer them dogmatically in an individual case.

Prior to 1887 the expectant treatment of fractures of the spine was practically always used. The mortality was so

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<sup>1</sup> Read before the American Surgical Association, July, 1905

large, and the suffering so distressing, that it led me to advocate immediate rectification of the spine and its fixation by a plaster-of-Paris jacket <sup>1</sup>

Open operations on the spine have been done occasionally since Henry Cline operated at St Thomas's Hospital in 1814, but all these operations were futile or followed by a fatal ending

Antisepsis and a simple method of doing laminectomy have rendered it possible to open the spinal canal and to look at the cord. An open operation gives definite information as to the condition of the cord, and above all allows pressure to be removed in some cases. Naturally an open operation quickly superseded immediate rectification, which was at best a "hit or miss" method of relieving pressure on the cord

The largest collection of fractures of the spine was made by Gurlt,<sup>2</sup> who reported 270 cases. Thorburn's<sup>3</sup> well-known work is of great value. Morton<sup>4</sup> considered the subject carefully. Lloyd<sup>5</sup> presented 227 cases and judiciously summarized the subject

The writer has twice reported the fractures of the spine at the Boston City Hospital, through the courtesy of his colleagues. The first series (82 cases) was published in the *Medical Communications of the Massachusetts Medical Society*, vol xiv, No 1, 1887, p 151. The second series (168 cases, which included the first series of 82 cases) was presented to the British Medical Society in August, 1894, and abstracts of the paper were published in the *Medical Press and Circular*, London, August 29, 1894, in the *British Medical Journal*, August, 1894, and in the *ANNALS OF SURGERY*, February, 1895.

The writer now presents a third series of 244 cases, which includes the two previous series. The details of the 244 cases are not presented, but a summary of the three series of cases is given, and a comparison of the different series is interesting and instructive.

These tables show the frequency of symptoms, the deaths and recoveries in the different regions, the mortality, the

duration of life in the fatal cases, and the results as to whether the patient is useful or useless in the recoveries

#### FIRST SERIES—1864-1887

*Frequency of Symptoms*—Total cases, 82    Crepitus, 51, 62.1 per cent, deformity, 63, 76.8 per cent, unconsciousness, 18, 21.9 per cent, paralysis, complete, 67, 81.7 per cent, paralysis, incomplete, 6, 7.3 per cent, paralysis, none, 9, 11 per cent, pain, 71, 86.5 per cent, priapism, 18, 21.9 per cent, delirium, 12, 14.6 per cent, cystitis, 31, 37.8 per cent, bed-sores, 27, 32.9 per cent

*Regions*—Total cases, 82    Cervical, 28, 34.1 per cent    Deaths, 25, 89.2 per cent, recoveries, 3, 10.8 per cent    Upper dorsal, 12, 14.6 per cent    Deaths, 8, 66.6 per cent, recoveries, 4, 33.4 per cent    Lower dorsal, 19, 23.1 per cent    Deaths, 18, 94.7 per cent, recoveries, 1, 5.3 per cent    Lumbar, 23, 28.0 per cent    Deaths, 13, 56.5 per cent, recoveries, 10, 43.5 per cent

*Mortality*—Total cases, 82    Deaths, 64, 78 per cent, recoveries, 18, 22 per cent

*Time*—Total cases, 82    Total deaths, 64, 78.0 per cent    Within 5 days, 39, 60.9 per cent, within 10 days, 8, 12.6 per cent, within 1 month, 7, 10.9 per cent, after 1 month, 10, 15.6 per cent

*Results*—Total cases, 82    Total recoveries, 18, 22 per cent    Useful, 9, 50 per cent, useless, 9, 50 per cent

#### SECOND SERIES—1887-1900

*Frequency of Symptoms*—Total cases, 114    Crepitus, 30, 26.3 per cent, deformity, 58, 50.8 per cent, unconsciousness, 14, 12.2 per cent, paralysis, complete, 93, 81.5 per cent, paralysis, partial, 14, 12.2 per cent, paralysis, none, 7, 5.1 per cent, pain, 58, 50.8 per cent, priapism, 37, 32.4 per cent (106 male cases), delirium, 29, 25.4 per cent, cystitis, 22, 19.3 per cent, bed-sores, 23, 20.1 per cent

*Regions*—Total cases, 114    Cervical, 44, 38.5 per cent

Deaths, 41, 93.1 per cent, recoveries, 3, 6.9 per cent Upper dorsal, 24, 21.0 per cent Deaths, 22, 91.6 per cent, recoveries, 2, 8.4 per cent Lower dorsal, 34, 29.8 per cent Deaths, 19, 55.8 per cent, recoveries, 15, 44.2 per cent Lumbar, 12, 10.5 per cent Deaths, 7, 58.3 per cent, recoveries, 5, 41.7 per cent

*Mortality*—Total cases, 114 Deaths, 89, 78 per cent, recoveries, 25, 22 per cent

*Time*—Total cases, 114 Total deaths, 89, 78 per cent Within 5 days, 67, 75.2 per cent, within 10 days, 7, 7.8 per cent, within 1 month, 8, 9.2 per cent, after 1 month, 7, 7.8 per cent

*Results*—Total cases, 114 Total recoveries, 25, 22 per cent Useful, 15, 60 per cent, useless, 10, 40 per cent

### THIRD SERIES—1900-1904

*Frequency of Symptoms*—Total cases, 48 Crepitus, 12, 25 per cent, deformity, 37, 77 per cent, unconsciousness, 9, 18.7 per cent, paralysis, complete, 25, 52.0 per cent, paralysis, partial, 7, 14.5 per cent, paralysis, none, 16, 33.3 per cent, pain, 42, 87.5 per cent, priapism, 11, 23.9 per cent (46 male cases), delirium, 2, 4.1 per cent, cystitis, 13, 27.0 per cent, bed-sores, 13, 27.0 per cent

*Regions*—Total cases, 48 Cervical, 14, 29.1 per cent Deaths, 11, 78.5 per cent, recoveries, 3, 21.5 per cent Upper dorsal, 7, 14.5 per cent Deaths, 3, 42.8 per cent, recoveries, 4, 57.2 per cent Lower dorsal, 22, 45.8 per cent Deaths, 4, 18.1 per cent, recoveries, 18, 81.9 per cent Lumbar, 5, 10.4 per cent Deaths, 0, recoveries, 5, 100 per cent

*Mortality*—Total cases, 48 Deaths, 18, 37.5 per cent, recoveries, 30, 62.5 per cent

*Time*—Total cases, 48 Total deaths, 18, 37.5 per cent Within 5 days, 11, 61.1 per cent, within 10 days, 1, 5.5 per cent, within 1 month, 3, 16.7 per cent, after 1 month, 3, 16.7 per cent

*Results*—Total cases, 48 Total recoveries, 30, 62.5 per cent Useful, 23, 76.6 per cent, useless, 7, 33.4 per cent

## SUMMARY OF THREE SERIES—TOTAL CASES, 244

*Frequency of Symptoms*—Crepitus, 93, 37·8 per cent, deformity, 159, 68·1 per cent, unconsciousness, 41, 17·6 per cent, paralysis, complete, 185, 71·7 per cent, paralysis, partial, 27, 11·3 per cent, paralysis, none, 32, 13·1 per cent, pain, 171, 74·8 per cent, priapism, 66, delirium, 43, 14·7 per cent, cystitis, 66, 28·0 per cent, bed-sores, 63, 26·6 per cent

*Regions*—Cervical, 86, 33·9 per cent Deaths, 77, 85·7 per cent, recoveries, 9, 14·3 per cent Upper dorsal, 43, 16·7 per cent Deaths, 37, 76·7 per cent, recoveries, 10, 23·3 per cent Lower dorsal, 75, 32·9 per cent Deaths, 41, 56·1 per cent, recoveries, 34, 43·9 per cent Lumbar, 40, 16·3 per cent Deaths, 20, 50·0 per cent, recoveries, 20, 50·0 per cent

*Mortality*—Deaths, 171, 64·5 per cent, recoveries, 73, 35·5 per cent

*Time*—Total deaths, 171, 64·5 per cent Within 5 days, 117, 65·7 per cent, within 10 days, 16, 8·6 per cent, within 1 month, 18, 12·1 per cent, after 1 month, 20, 13·3 per cent

*Results*—Total recoveries, 73, 35·5 per cent Useful, 47, 62·2 per cent, useless, 26, 37·8 per cent

The writer recognizes that statistics may be very deceptive, and that they may be made to prove almost anything, yet certain generalizations may be drawn from them The figures speak for themselves, but it should be remembered that the observations and the records were made by a constantly changing staff of surgeons

I have purposely refrained from drawing deductions from these figures, for I find that Dr Crandon, who has carefully gone over the records, arrives at one conclusion and I arrive at another If two individuals can reach different conclusions from an analysis of the same cases, it shows clearly the fallacy of attempting to generalize from cases that have been observed and recorded by many different surgeons For this reason the reader must critically analyze these figures and draw his own conclusions



The most striking statistics are those of the mortality in the first series when compared with the mortality in the third series. In the first series there was 78 per cent of deaths, in the third series there was 37.5 per cent of deaths. This extraordinary difference in mortality is due to the inclusion of fractures of the spine which did not have paralysis, in the statistics of the third series. In the first series of cases, if paralysis was not present in some degree, the case was not considered to be a fracture of the spine. For this reason the mortality tables of the summary of the three series cannot be accepted at their face value. Injuries of the spinal column that were formerly considered to be wrenches of the spine are to-day known, in some instances, to be fractures of the spine without cord symptoms. These cases are brought to the hospital with what is thought to be a minor injury, and are sooner or later recognized as fractures of the spine. The nursing care of patients has greatly improved, and this has doubtless diminished the mortality.

The three types of cases that I recognize are the following: 1. Cases in which the cord is crushed. 2. Cases in which doubt exists as to whether the cord is irremediably damaged. 3. Cases in which it is fair to assume that the cord is not irremediably damaged.

1. Cases in which the cord is crushed. This forms by far the largest class of spinal injuries. I append autopsy reports (for which I am indebted to the Pathological Department of the Boston City Hospital) of several of the cases to show the mechanics of absolute cord destruction.

(1) Anterior portion of twelfth dorsal vertebra broken into fragments. Largest wedge-shaped 3 centimetres long, entire body pressed backward. Compressed so that intervertebral disks above and below have largely disappeared. Posterior portion of body forms a knuckle-like mass projecting towards cord, elevated over 1 centimetre above level of the other vertebræ, on the cord, corresponding to the projection of the posterior surface of the body of the twelfth vertebra, is an area of softening 1 centimetre in length. At the lower

border is a marked constriction, the anteroposterior diameter of the cord being reduced one-half. This occurs at a point 3.5 centimetres above the tip of the conus medullaris. The softened portion is grayish white and translucent on section.

(2) Arches of spinous processes of first and second dorsal vertebræ absent (operation). Cord at this point appears normal. No blood in spinal canal. On anterior aspect of spinal column, fifth cervical projects anteriorly 5 centimetres in front of cord, which is dislocated backward. Fourth is freely movable on fifth, and also fifth somewhat less degree on sixth. Body of sixth anteriorly is movable with crepitus, and spinous processes with a portion of arch of this same vertebra can also be moved freely from side to side. There is apparently fracture of transverse processes of fifth cervical vertebra.

(3) Examination of spinal column from anterior surface showed transverse fracture of body of seventh cervical vertebra. Small bony fragments projected into adjacent tissue. Arches of sixth and seventh cervical were comminuted. On posterior surface of dura, beneath arch of seventh cervical and to less extent beneath that of sixth, was a small amount of dark, red coagulated blood. No hæmorrhage within dura. Vessels on surface of cord were injected. Distinct softening of cord opposite point where sixth nerve is given off.

(4) Spines of seventh and eighth dorsal vertebræ not present. Opposite bodies of seventh and eighth cord is sharply compressed by knuckle from posterior portion of bodies. On opening dura the cord was found completely divided, the upper portion being separated from lower by space 4 centimetres. The torn ends of cord end blindly in mass of fibrous tissue. Body of eighth dorsal was seen to have been forcibly driven backward and crushed between seventh and ninth dorsal. Lower portion of ninth exhibited old line of fracture with new formation of bone at about middle of body. No evidence of articular cartilage between eighth and ninth dorsal. Ninth projected into spinal canal at a sharp angle, about 45 degrees. Above angle made by displaced ninth there was a new growth of bone along front of spinal canal, making angle less prominent.

(5) A sharp knuckle of bone is found pushing into spinal canal anteriorly and corresponding to upper portion of body of first dorsal vertebra. This knuckle represents body of first dorsal. The articular cartilage between first dorsal and seventh cervical having been crushed and ligaments torn, the body of vertebra was forced back, producing angle in canal. Cord over knuckle was found softened and discolored by hæmorrhage into it. Microscopically for about 2 centimetres above and below there was blood in posterior horn.

(6) Roughened area in region of first lumbar. Body of twelfth dorsal much narrower on left than on right, bone having been apparently crushed on left side. Irregular fracture body of first lumbar with a fragment projecting posteriorly into spinal canal. Cord degenerated from upper dorsal to cauda equina.

(7) Eighth dorsal vertebra divided by oblique fracture beginning about middle of body and extending on each side upward and backward through body, pedicles, and laminae. Cord for about 2 centimetres opposite site of fracture is narrowed and completely softened. Cord for about 1 centimetre above and below this shows central cavity partially filled with thick red fluid. This cavity corresponds in form and size with portion of cord usually occupied by gray matter. Fluid contains compound granular cells,—irregular nerve fibres.

(8) Upper lumbar displaced to left, dislocation forming marked angle with adjacent dorsal vertebra. Unnatural mobility here. Spines of twelfth dorsal and first lumbar were separated one inch, ligaments torn. Fracture of body of first lumbar. Portion of cord two inches long over displaced ridge of first lumbar distinctly softened. Over projection the cord was brown and diffuent, completely disorganized.

(9) There was a displacement between second and third dorsal vertebræ, body of the second being forced backward and to the right about one-fourth of an inch. This displacement was more apparent upon examination of spine posteriorly, spines and cord having been removed. Second and third spines were broken at their tips. Cord in this region was

overlaid by thin, soft clot, and there was a region of softness one-half inch long, which upon section displayed a considerable effusion of blood into cord. Whole cord at this level was disorganized.

(10) Spinous process of sixth cervical vertebra was broken, and there was a separation between the fifth and sixth, admitting tip of finger. There was also a separation between bodies of fifth and sixth through intervertebral disks, with rupture of ligament to such a degree as to permit displacement of fifth forward nearly one-fourth of an inch. No free blood in meninges. In immediate relation with vertebral injury, spinal cord shows a mass of softening through one-half of its length extending through entire thickness. The consistency and color of cord at this point are that of thick cream.

(11) Examination of spinal column anteriorly reveals nothing abnormal. Spinous processes of the fourth and fifth cervical were widely parted, and fourth was displaced slightly forward. Fracture through body of fourth and through cartilage below it. Cord at this point was compressed, soft, and red. No blood within dura, compression being wholly due to displacement of fragments.

(12) Abnormal mobility between fifth and sixth cervical with anterior displacement of fifth to extent of one-fourth of an inch. Fifth and sixth spines separated, following rupture of their ligaments. Fracture of intervertebral disks below fifth, with separation of articular surfaces of transverse processes. Little blood outside dura, within dura, around cord, very little. At point of fracture the cord was shrunken, soft, and red. The extent of the lesion was about three-fourths of an inch.

(13) Anteriorly, second lumbar presents fracture through its body. Considerable amount of effusion of blood in spinal canal outside dura. Section of dura shows cauda equina without lesion or surrounding hæmorrhage.

(14) Complete crushing of third, fourth, fifth, and sixth cervical vertebræ. Cord not removed, owing to complete destruction and crushing.

2 Cases in which doubt exists as to whether the cord is irremediably damaged These cases should probably always have an open operation, but will be considered later

3 Cases in which it is fair to assume that the cord is not irremediably damaged This class is of great interest and importance

Dr L R G Crandon, of Boston, has collected a series of seventeen cases of fracture of the spine without marked cord symptoms which have come under his personal observation He has pointed out to me that if they are unrecognized they may end most disastrously

#### FRACTURE OF THE SPINE WITHOUT MARKED CORD-SYMPTOMS

1 Male, aged ten years Buried by a cave-in of sand and gravel, brought immediately to hospital Marked tenderness over lower dorsal and first lumbar spines, with swelling and kyphos Reflexes normal and no evidence of paralysis Patient put on Bradford frame and fastened to it by swathe Twenty-two days later plaster-of-Paris jacket applied One month after injury patient up with jacket, and two days later discharged, with marked knuckle in lower dorsal region and definite limitation of intervertebral flexibility, but no evidence of injury to the cord

2 Male, aged six and one-half years So far as can be learned, an iron pipe fell on patient's side or back Patient semi-conscious, color good, pulse 130, slight bleeding from both nostrils, reflexes of eyes, trunk, and extremities normal Crepitus and abnormal mobility of ninth and tenth dorsal spinous processes of second and third left ribs Discharged in one month with no evidence of cord-injury, but with slight scoliosis

3 Male, aged thirty-nine years Fell into hold of steamer Pale, conscious, apparently in pain Sternum fractured Back shows continuous curve from base of neck to first lumbar with marked kyphos at sixth dorsal At this point is abnormal separation of spines and great tenderness No crepitus made out Abdomen, marked spasm of both upper quadrants No paralyses, and reflexes all normal Bradford frame Retention of urine made catheterization necessary for three days In eight days the kyphos still persisted, but sensation and motion of lower ex-

tremities were normal In six weeks sat up with back carefully supported Plaster jacket applied with spine hyperextended In eight weeks sat up in chair and was without symptoms

4 Female, aged twenty-six years Fell one story, striking on back across an iron fence Unconscious for an hour Marked knuckle at twelfth dorsal vertebra Knee-jerk present on left, absent on right No paralysis or lack of sensation made out Bradford frame Two and one-half weeks, plaster jacket Radiograph negative In six weeks was up and about with jacket, no symptoms Discharged at her own request

5 Male, aged twenty-two years "Jack-knifed" while driving through a low doorway Unable to walk, legs paretic, but sensation normal Severe pain across back and marked abdominal spasm Distinct kyphos at twelfth dorsal, but this seems to consist of hematoma and of a loose spinous process, giving crepitus Retention of urine called for catheterization for seventeen days At end of two months was discharged with "stiffness of back," but no other abnormality

6 Male, aged twenty-four years Fell from a tree about fifteen feet Conscious Cyanotic Pulse, 80, reflexes absent, Babinski on both sides Both lower extremities delayed in sensation and paretic in motion for twelve hours After that normal Eighth dorsal spine unduly prominent, just below it a distinct gap, ninth process not felt Patient got out of bed several times the first night without new symptoms Bladder and rectum normal from the first At the end of one month was discharged at his own request, with plaster jacket, no symptoms

7 Male, aged twenty-three years Fell three stories Conscious, tender prominence over eleventh and twelfth dorsal vertebræ No crepitus or disturbance of motion or sensation Reflexes normal Slight priapism Bradford frame In four weeks priapism continues, but no other cord-symptom has been noted In one month patient up (on his own insistence) and walks about, without back support, somewhat stiffly Discharged

8 Female, aged twenty-six years On the tenth day of typhoid developed delusions, and jumped from a second story window to the ground, about thirty-five feet The patient was unconscious, respirations were rapid and shallow, slight cyanosis There was marked prominence of the ninth, tenth, eleventh, and twelfth dorsal, and first lumbar vertebræ, with evident separation

of spines of twelfth dorsal and first lumbar No paralysis or anæsthesia Abdomen distended Kyphosis persists Death at end of three days

9 Male, aged thirty years "Jack-knifed" under a bale of cotton Conscious Crepitation and abnormal mobility of eleventh dorsal spine No paralysis or anæsthesia Discharged well

10 Male, aged forty-seven years Fell one story down elevator well Slight kyphos at second lumbar vertebra Reflexes, sensation, and motion normal Sat up in twelve days, with no sign of injury except the persistent knuckle

11 Male, aged thirty-two years A mass of twenty-eight bricks fell on patient's bent back Conscious Marked separation of fourth and fifth dorsal spines, enough to admit tip of finger Just above this, fourth spine is unduly prominent No paralysis or other sign of cord injury Up and about in fourteen days without symptoms

12 Male, aged thirty-eight years Fell down stairs Conscious Soft swelling in dorsolumbar region Twelfth dorsal spine unduly prominent Sensation, reflexes, sphincters, and other muscles not affected in any other way Discharged in seventeen days against advice

13 Male, aged sixty years Was thrown down a flight of stairs Conscious Dyspnœa Abnormal mobility, crepitus, and pain over third and fourth dorsal spines Discharged without symptoms in four days

14 Male, aged sixty years Fell off a bridge Conscious Reflexes normal No loss of motion or sensation made out, but a marked kyphos over eleventh and twelfth dorsal spines Much abdominal spasm No symptoms of cord injury developed during two months At the end of that time, although the deformity persisted, patient was up and about in plaster jacket

15 Male, aged thirty-two years Fell thirty-five feet from an electric-light pole Conscious Reflexes normal General abdominal spasm No loss of motion or sensation, but a definite kyphos over first lumbar spine Retention of urine first twenty-four hours Discharged in two months with persistent kyphos and wearing plaster jacket

16 Male, aged twenty-six years Intoxicated and in a fight fell from a second story window to the ground Conscious Color good, breath alcoholic, pupils equal and react, tongue

protrudes straight, pulse 100, regular, good quality, fine tremor of both hands General abdominal tenderness and spasm, no motor paralysis Slight prominence of spine of first lumbar vertebra Considerable tenderness over this region, some pain on motion, no crepitus or abnormal mobility of spinous processes, able to move legs without difficulty, sensation normal Plaster jacket applied with lordosis Discharged after seven weeks Able to walk slowly, with great sensation of weakness in lumbar region and dependent upon plaster jacket

17 Male, aged forty-one years Tried to jump from one roof to another and fell four stories Semiconscious Apparently in great pain Marked pallor Pupils equal and react Tongue not protruded on request Pulse 120, regular, but of poor quality Marked kyphosis, with apex of the knuckle at the junction of the tenth and eleventh dorsal vertebræ, where there is considerable separation of the spines Marked abdominal tenderness and spasm Knee-jerks absent Cremasteric present Patient grew worse through the day, and in five hours was in a state of collapse A pint of adrenalin solution, 1 to 50,000, was introduced into the vein of the arm, and this was repeated twice at intervals of six hours Pulse immediately responded and general condition improved There was no motor paralysis at any time The patient was kept on a Bradford frame, and was discharged at the end of four months with a plaster jacket This man was brought into the hospital by the police in a chair, his head and the upper half of the trunk collapsed forward A knuckle in his back presented, the whole picture being that of Pott's disease Immediate rectification was done to the extent only of placing the man on his back, and there he remained until complete union had taken place At no time were there any cord symptoms

This series of cases is, I think, worthy of careful consideration Presumably in the past these cases have not gone to a hospital The injury to the vertebræ in some of these cases is assumed from the symptom-complex, not from the existence of crepitus and abnormal mobility It must be remembered that in certain adult spines there is present a kyphos that is not dependent upon an obvious pathological lesion

There can be but little doubt that cord symptoms may



develop from the displacement of a fracture of the spine where the cord has not been permanently injured Dr Crandon has seen one such case that deeply impressed him It is as follows

Male, aged fifty-five years Fell down an elevator well and was brought immediately to hospital There was marked tenderness over the seventh cervical and the three upper dorsal vertebræ, together with slight spasm of the neck No crepitus made out Pulse, 74, temperature, normal, respirations, 17 No paralysis or anæsthesia Reflexes present and normal Full control of sphincters

Patient was put to bed, and cautioned not to sit up or to roll in bed, because there was injury to his back which might be more than was then apparent Four days after injury, however, when unattended, *he sat up in bed and immediately complained of numbness of the limbs and body* Examination then showed a paresis of all the skeletal muscles from the neck down and diminished cutaneous sensation from the clavicle downward Reflexes increased Abdomen somewhat distended Bladder parietic and sphincter an relaxed

Two days later the plantar reflexes and the knee-jerks were absent, absolute paralysis of lower extremities Right arm very slight power of flexion and slight power of supination, extension of elbow lost, pronation of wrist lost, very slight power of deltoid, pectorals and latissimus dorsi lost Sensation blunted to pin-prick over ulna half, sharp over ball of thumb, blunted over both sides of forefinger, lost over middle finger, sharp over deltoid, sharp over radial aspect of forearm Left arm. flexion good, extension of forearm lost, deltoid, pectorals, and latissimus fair, pin-prick of limb diminished, radial aspect diminished, over deltoid normal, ulnar side diminished Sensation absent from toes to level of fourth rib, and blunted from fourth to second rib Pupils equal and not dilated Diagnosis Complete injury at seventh segment, sixth segment blunted

Operation advised at the first onset of these symptoms Not accepted, and patient died at the end of a month, with the usual picture of fractured spine and complete destruction of the cord Autopsy showed fracture of the first dorsal and complete degeneration of the cord at that level, but without macroscopic change in the envelopes of the cord

In the care of this class of bony injury of the spine, surgery can protectively be of great value. To the police, to hospital attendants, to house officers, and to medical students, the instruction for the care of injuries to the back should be "*hands off*" Let the patient be transported to the surgeon, so far as is possible held fixed in the position in which he is found

*Can we tell whether a spinal cord is irremediably damaged or not?* In some cases it is obvious from the character of the injury that the cord is severed or crushed. A total transverse destruction of the cord may be deduced from the *persistence* of the following symptoms: the total loss of all reflexes, complete insensibility to touch and pain, and motor paralysis below the level of the lesion

Thomas,<sup>6</sup> whose work on the changes in the spinal cord following fracture of the spine is of great value, stated that the "factors in drawing the conclusion that there is a complete transverse lesion of the cord are

"1 Complete paralysis, usually of a flaccid type

"2 A complete loss of sensation in all its forms

"3 Absent reflexes, especially the knee-jerk, while the plantar reflex, on the contrary, is often retained

"4 Complete paralysis of the bladder and rectum, with priapism

"5 Vasomotor paralysis, with severe sweating in the paralyzed parts

"6 And, most important, absence of variations in the symptoms

"7 Absence of irritative phenomena, such as pain"

Walton,<sup>7</sup> who has studied fractures of the spine, states, "There are no symptoms which establish (otherwise than through their persistence) irremediable crush of the cord"

"While total relaxed paralysis, anæsthesia of abrupt demarcation, total loss of reflexes, retention, priapism and tympanites, if persistent, point to complete and incurable transverse lesion, the onset of such symptoms does not preclude a certain degree at least of restoration of function" He also states that we have no infallible guide to the extent of the lesion

*Treatment*—The treatment of fractures of the spine comes under the following headings (1) Expectant, (2) reduction and fixation, (3) operation (laminectomy) which may be (a) primary, (b) secondary. The selection of the kind of treatment should depend on what injury to the cord exists or what injury to the cord is likely to occur.

(1) Expectant treatment. This mode of treatment is applicable to fractures of the spinous processes or even of other bony structures where there are no cord symptoms. The expectant treatment consists in having the patient fixed in bed, preferably on a Bradford frame, to facilitate his care. The nursing care is most important. The expectant method is one which manifestly holds out little hope of complete recovery in cases of definite cord injury.

(2) Reduction and fixation. The immediate, bloodless, rectification of a fracture of the spine, and its fixation by a plaster-of-Paris jacket, was the mode of treatment which I advised in selected cases in my first series. If a detailed local examination is to be made, the patient should be turned only as a whole. Rectification should be attempted very slowly, so far as is possible, in the axis of the spinal column. During every step of this operation it is desirable that the condition of the cord, as shown by sensation, motion, and reflexes, should be known. Should the slightest sign or symptom of cord injury or pressure develop, the rectification should stop and an immediate open operation be done. If the kyphos is very marked, or if upon extension it does not readily reduce, an immediate operation, unless there is some contraindication, such as shock, should be done, that the reduction may take place while the cord is under the surgeon's eye. The deformity may be corrected and the jacket applied, with the body suspended, or by the horizontal hammock suspension position. In short, the jacket should be applied after reduction has been attempted by firm even pressure at the site of the deformity, with enough hyperextension to open the narrowed canal to its normal limits.

In 1887 I collected sixteen cases of immediate rectifica-

tion of the spine and fixation with a plaster-of-Paris jacket. Of these, three died, three derived no benefit, and ten were greatly improved. The conclusions reached by the writer in 1887 were as follows:

"First. That, in the *immediate* correction of the deformity and fixation with plaster-of-Paris jacket or other means, we have a rational method of treating a large number of cases of fracture of the spine. Second. That, considering the hopelessness of results in fracture of the spine when treated expectantly, almost any risk is justifiable. Third. That the *immediate* correction of the deformity is imperative, *if* softening of the cord can and does occur from pressure at the end of forty-eight hours. Fourth. That the suspension of the patient is only a means of rectifying the deformity, that certain fractures could be simply pressed into position while the patient lies prone or supine.

"The objections to the treatment are,

"1st. That the expectant plan of treatment gives a small percentage of recoveries. 2d. That there are serious risks, especially in the cervical region, attending the suspension of a patient and the rectification of the deformity with a fractured spine, in the way of shock, collapse, and death. 3d. That in attempting to relieve pressure on the cord, by rectifying the deformity, we might either sever the spinal cord or make pressure upon it. This is a matter of chance.

"My own belief regarding the status which the procedure should occupy in surgery is, that it will occasionally be a life-saving measure, that it should be applied under anæsthesia in all cases of fracture of the spine which are not conclusively known to be irremediable, and that, apart from the chance of recovery offered to the patient by this means, it will almost invariably make the patient more comfortable, in that he can be handled more easily."

In 1894, in the second series (86) cases, the percentage of recovery was 33. The treatment had been influenced by the first paper in 1887. In the first series of cases, 18 patients recovered, 9 recovered "useful," that is, could walk, and 9 recovered "useless," that is, were bedridden. In the second series of cases (86), 28 recovered, 19 were "useful," and 9

were "useless" Not all of the cases were treated by the immediate rectification of the deformity, in fact, it was applied during the year 1887 four times, during the year 1888 twice, during the year 1889 three times, during the years 1890 and 1891 twice, and only once in 1893

More experience, as is usually the case, has brought more light, and I now believe that the indication for immediate reduction and fixation is for cases of fracture with no cord symptoms, and for cases not hopeless which refuse an open operation

(3) Laminectomy The technique of the operation that I use is practically described by Munro<sup>8</sup> A single incision is made in the median line and is carried down to the lamina on either side close to the spinous process The wound is packed and the lamina on the other side is exposed in like manner The interspinous ligaments above and below the selected spine are cut with blunt scissors curved on the flat The spinous process itself is bitten off with a rongeur, the laminae are next cut near the middle line with small bone forceps, and the intervening piece removed, thus exposing the cord without even putting it in danger of injury Successive laminae should be removed until it is positive, without any chance of error, that all compression of the cord, above and below, or of spinal nerves still in the canal, is removed The dura should be opened freely, spicules of bone should be removed, the dura should not be sutured, and drainage by a bit of rubber tissue may or may not be necessary

In the open operation lies our hope,—a hope, unfortunately, and nothing more The advocates of operative surgery of spinal cord injury are divided into those who favor immediate operation and those who advise a delayed operation Relatively few surgeons are in favor of an operation within a few hours The arguments against immediate operation are that an injury which has involved destruction of the cord is already done, and will get no worse in a few hours The patient is still suffering from spinal and general shock

I believe in immediate operation unless it is distinctly

contraindicated by shock. The reason I believe in immediate operation is that no one can positively state in what condition the spinal cord is until he looks and sees, and if pressure exists on the spinal cord, and it is allowed to persist for many hours, irreparable damage to the cord may result. I recognize that it would be advisable to exclude spinal concussion, which at times might simulate pressure on the cord, but while waiting for the spinal concussion to clear up, if pressure on the cord exists, irreparable damage may result. I agree largely with Walton and Lloyd in fearing delayed operation in cases which have recovered from their first shock and have in them anything objectively hopeful.

OLIVER<sup>9</sup> states that "a point which has been regarded as very important in these cases is the length of time that elapses between the receipt of the injury and the performance of the operation. The usual advice has been to operate as soon after the infliction of the injury as is possible, because of the fear that prolonged pressure may of itself produce degenerative changes in the cord from which the patient never recovers." Dr. Oliver states that "analysis of the statistics seems to throw some doubt upon the correctness of this dictum." He instances cases by Lauenstein, McCosh, Huss, Starr, Wyeth, and one of his own cases, where recovery had occurred from late operation on a fracture of the spine. Dr. Oliver says, "If the injury is not irreparable at the time of accident, it is unusual for bony or other pressure to cause a permanent abolition of function."

I recognize that the successful laminectomies for fracture of the spine have almost invariably been late operations. Notably this is the fact in Horsley's cases. If, however, the late operations are successful at times, it perhaps may be assumed that these same cases would have been successful if an operation had been done early, at least, they would not have been subjected to the risk of uncertainty as to whether pressure on the cord was producing irremediable damage. I cannot believe that pressure on the cord should be allowed to persist any longer than is imperative from the general condition of the patient.

THORBURN<sup>10</sup> is pessimistic. Speaking of seven cases of operation, he says, "In none of the cases did any real benefit result, all those in which the injury was in the cervical region died, all those in which it was below the cervical lived, but did not recover from paralysis" "The published cases, of which there are about 200, show to my mind no better results, if we exclude injuries of the *laminæ*, hæmorrhage, and operations upon the *cauda equina*. I have, indeed, not satisfied myself that there have been any successes, as regards recovery of function, save such as may be attributed to the regeneration of nerve roots only, or to the natural recovery of a cord which was but very slightly injured" "And, further, if it were shown that in one or two instances among the 200 published cases there had been a definite improvement or recovery, I should be inclined to regard such as the sequel of some error in the original diagnosis, rather than to allow a single instance to invalidate a rule based upon such extensive premises."

LLOYD<sup>11</sup> is more hopeful and, it seems to me, just in his estimate of the surgical results in these cases. He says, "It is, therefore, evident that if we operate immediately after the injury we will have failures that should not be charged against the operation itself, and, if possible, we should wait before operating until the question can be settled whether the patient will overcome the shock or succumb directly to the effects of the injury."

"There is another objection to immediate operation. In so-called concussion of the spine, there may be a certain amount of anæsthesia and paralysis. The recovery, however, will be complete, or at least so nearly so that no appreciable lesion can be made out. Immediate operations in these cases would be unnecessary, as they would have recovered spontaneously had they been left alone for a sufficient length of time. It is impossible, too, in the first few hours, to determine with any degree of certainty how severe the injury really is, nor can we absolutely localize the injury to the cord. In my opinion, therefore, we should wait until this period of shock has passed and until it is evident that there will be no spon-

taneous recovery complete enough to render life bearable. If, after this period has passed, the patient still continues to improve, no operative interference should be considered, but as soon as the symptoms begin to show retrograde phenomena or seem to have reached the end of the improvement operation should be undertaken."

LLOYD<sup>12</sup> published the following table of laminectomies in 1902

Cervical Region		Immediate Operation	Later Operation
Deaths		21	2
Recovery		0	2
Improved		2	1
Not improved		0	4
Subsequent death		4	3
		—	—
		27	12
Dorsal Region		Immediate Operation	Later Operation
Deaths		23	5
Recovery		4	10
Improved		9	18
Not improved		6	16
Subsequent death		7	16
		—	—
		49	65
Lumbar Region		Immediate Operation	Later Operation
Deaths		4	4
Recovery		1	6
Improvement		1	6
No improvement		0	4
Subsequent death		0	2
		—	—
		6	22
Sacral Region		Immediate Operation	Later Operation
Deaths		0	0
Recovery		0	1
Improved		0	3
Not improved		0	0
Subsequent death		0	0
		—	—
		0	4

He states that "these statistics are decidedly against immediate operation, and we must urgently advise never operat-



ing until it is evident that the patient will not succumb to the direct effects of the injury. As soon, however, as he has recovered from the shock and his exact physical condition is known the operation should be performed."

VICTOR HORSLEY's cases, reported to the British Medical Association in 1895,<sup>13</sup> are the most brilliant. Of the seven cases reported, three were fractures of the spine. They are as follows:

1 "There was a fracture of the cervical spine, with paralysis of all four limbs, which had lasted eight months. The paralysis began to extend. Analgesia was present, and this always points to an affection of the central gray matter of the cord. The laminae of the fifth and sixth cervical vertebræ were removed, and the thick fibrous tissue was dissected off the dura mater. The patient steadily improved, and only wasting of the interossei remained."

2 "The patient had fallen from a cart, striking his head and right shoulder. He walked about for a week, but gradually lost power in all his limbs. When admitted to Queen's Square Hospital, fracture of the sixth cervical vertebra was diagnosed. The left optic disk was swollen. Laminectomy of the fourth, fifth, and sixth cervical vertebræ removed a ridge which had been pressing on the spinal cord. Power began to appear on the twelfth day. He has since recovered completely."

3 "The patient sustained a fracture of the sixth cervical vertebra, the onset of paralysis was gradual. There was marked contracture and well-marked anæsthesia of the postaxial border of the upper limbs. The arches of the sixth and seventh cervical vertebræ were removed when a projecting ridge was felt, but on extension this disappeared. He is recovering slowly."

The last case may have been a fracture of the spine, and is reported as follows: "The patient had struck the fore part of his head, and after walking 200 yards rapidly became completely paralyzed. After partial recovery spastic paraplegia appeared, with postaxial anæsthesia of the upper limbs. The laminae of the sixth and seventh cervical vertebræ were removed. Permanent recovery commenced three weeks after the operation. He can now walk a mile."

The following is a list of some of the laminectomies that have been collected from the literature of the subject since Lloyd published his table. It must be recognized that it is not common for surgeons to publish their unsuccessful cases.

VAN ENGELEN<sup>14</sup> reports three operative cases.

1 Paraplegia as the result of a fresh fracture. The cord was found crushed to a pulp, death in fourteen days.

2 Fracture of skull and spine, apparently dying After trephining both skull and spine consciousness returned, motor and sensory power in the lower extremities reappeared, but patient died three weeks later from tetanus

3 A young woman after fracture of the spine suffered paraplegia and pains of the legs Since sensation was retained, operation was done Paraplegia was not relieved

HAHN, E,<sup>15</sup> reports four cases

1 Man, aged fifty-one years Fell three stories, much shock, paralysis of both legs Sensation doubtful because drunk Next day pulse better, paralysis persisted, reflexes gone, incontinence, complete loss of sensation from Poupart's down Operation three weeks later Fracture third lumbar up to twelfth dorsal A fragment of twelfth dorsal narrowed the canal, pressing along 1 centimetre of the cord The dura was opened and the wound drained Pain was relieved and sensibility improved for a time

2 Man, aged thirty-eight years Fell twenty-five feet, conscious, with pain, paralysis of right leg and bladder, some power in left leg, which disappeared in twenty-four hours Reflexes lost, sensibility of legs much diminished Retention of urine, incontinence of fæces Operation in six days Fracture of the first lumbar, change in canal noted anteriorly The cord compressed slightly but not torn, wound drained Some sensation returned, but patient died in one week

3 Man, aged forty years Fell three stories, paralysis of both legs, sensation lost from pubis down Operation nine weeks later First and second laminæ removed A bit of bone was driven under the cord and compressed it from behind, forward Fragments were removed In one week bladder and rectum improved The wound healed Four months later the patient was discharged, with mobility and sensation not improved

4 Man, aged twenty-two years Fell twenty feet into water, and his horse fell after him, swam ashore with arms only, had pain in the back and was numb in the legs Sensation of legs gone, mobility from hips down lost Operation three days later Fracture of last dorsal and first lumbar, compression of cord by fragments, dura not open, the cord seemed normal Died without improvement

WINNETT<sup>16</sup> collected six cases which may be called successful, and to these added one of his own on which Peters operated The cases are as follows

1 Surgeon, McCOSH Man, aged thirty-three years Eighteen months previously sustained a fracture or dislocation of the fourth, fifth, or sixth cervical For nine months bedridden Caused by shackle falling on his head and doubling him up Completely paralyzed below the clavicles At time of operation, atrophy of muscles, but stands with

assistance Spastic paralysis of left arm Some use of right arm, but not of hand Constant pain in upper limbs Operation Fourth displaced one and a quarter inches to left Removed arch of fifth, dura very vascular and attached to arch Not opened Result Gets about, uses arms, walks four miles, and writes with left hand

2 Surgeon, JOHN A WYETH H A, aged twenty-one years September 1, 1889, thrown from a cow-catcher to track Loss of motion from pelvis down, bladder and rectum paralyzed Operation, April 30, 1890 Removed laminae, last two dorsal, and upper two lumbar Bodies found crushed, and cord partly divided Undivided part compressed by laminae of vertebra above and body below Compressing bone was removed and dura closed Result Immediate slight improvement in motion, especially in feet In 1894, good use of legs and feet, but uses cane

3 Surgeon, RIDENAUER M N, aged twenty-eight years December 11, crushed by an overhead beam in such a manner as to crush centre of his back forward at an acute angle, frightfully lacerating and crushing parts Seventh dorsal depressed one inch, and eighth absent Lamina of seventh dorsal broken and separated Transverse processes of seventh torn off Intervertebral disks of seventh forward one inch Spinous process of eighth penetrating cord Body of eighth fractured Membranes punctured and lacerated, and hæmorrhage into arachnoid space Operation Removed roof from sixth and ninth dorsal Sensation returned at once Motion in recti at end of fourth day Catheter required till seventh day Sphincter ani restored at end of first week Knee-jerk restored at end of second week Lift limb from bed at end of fifth week Walk with crutches at end of three months

4 Reported in *American Journal of the Medical Sciences*, April, 1892 Fracture dislocation between tenth and eleventh dorsal Opened five hours after, and large extra-theclal clot washed away, vertebræ reduced, and spines held together by silk Paralysis and hyperæsthesia passed away

5 Surgeon, BOYLE S M, aged twenty years Struck in back by train May 8 Loss of motion and sensation below hips Reduction failed For first week catheterization Pain and hyperæsthesia in both legs Operation July 12 Dislocation backward between ninth and tenth, above and forward of last dorsal, and first lumbar below All arches removed and bodies grooved Second day after operation slight movement in toes, also sensation At present has good sensation and motion

6 Surgeons, CHURCH and EISENDRATH Fracture dislocation of tenth dorsal, with complete paraplegia Extra-dural hæmorrhage found, clot removed, and vertebræ reduced Result Cured

7 Surgeons, PETERS and WINNETT Male, aged twenty-nine years Dived into four feet of water, his head doubling under him Physical examination Mind clear, sensations normal down to nipples Tactile sensation present, but indistinct over the remainder of the surface, with

the exception of the forearms and hands Contact of clothes was hot and painful No other pain since Retention of urine Paralysis of rectum Contraction of pupils Irregularity of fourth and fifth cervical spines All muscles below the neck, except the diaphragm, paralyzed A small spicule of bone was found in the membranes over the fourth left lamina The spine of the fourth was bent to the left The membranes were opened, blood and spinal fluid escaped, and pulsation returned The case was discharged the nineteenth week, with bladder normal, and patient able to move left hand

The writer presents the following conclusions

*First* That fractures of the spine may well be divided into two classes first, fractures of the spine with injury to the cord, and, second, fractures of the spine without injury to the cord

*Second* That it is not best to decide what the treatment of an individual case of fracture of the spine should be from the statistics, because the lesion varies so widely

*Thrd* That in many cases of fracture of the spine it is impossible to primarily state whether the cord is crushed or pressed upon by bone, blood, or exudate, except by an open operation

*Fourth* That only by the *persistence* of total loss of reflexes, complete insensibility to touch and pain, and motor paralysis below the level of the lesion, can total transverse destruction of the cord be diagnosticated

*Fifth* That if pressure on the cord is allowed to remain for many hours, irreparable damage to the cord may take place

*Sixth* That unless it is perfectly clear that the cord is irremediably damaged, an open operation to establish the condition of the cord and to relieve pressure is imperative as soon as surgical shock has been recovered from

*Seventh* That in certain cases of fracture of the spine, when the cord is not injured but is liable to injury from displacement of the fragments of a vertebra, rectification of the deformity and fixation of the spine may be used

*Eighth* That if the cord is crushed, no matter what treatment is adopted, there will, of necessity, be a high rate of mortality

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# A CASE OF SUTURE OF THE SPINAL CORD FOLLOWING A GUNSHOT INJURY INVOLVING COMPLETE SEVERANCE OF THE STRUCTURE<sup>1</sup>

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A E, aged eighteen years, clerk, born in the United States, single, was admitted to the Brooklyn Hospital on April 28, 1903, with the following history

Shortly before admission he had been shot in the back, his assailant using a 38-caliber revolver at a distance of about thirty feet, the shooting took place somewhat from the right side. He suffered severely from shock, and paralysis of the lower extremities occurred at once.

Examination on admission. The bullet wound was located one and one-fourth inches to the right of the median line and on a level between the tenth and eleventh dorsal spines. He is found to be paralyzed below the waist, sensation is absent over all of both lower extremities and over the abdomen as high as one inch above the crest of the ilia on the sides, and about half-way between the symphysis and the umbilicus in front. The bladder and rectum are also paralyzed. The bowels move involuntarily and irregularly and without the volition or cognizance of the patient, there is considerable twitching of the muscles of both legs, especially the toes.

Operation May 9, 1903. Ether anæsthesia. An incision was made six inches long over the spines of the vertebræ, the middle of the incision resting upon the eleventh dorsal spine. The laminae of the tenth, eleventh, and twelfth vertebræ were removed by the chisel. The bullet was found lying transversely between the severed ends of the cord, concealed from view by a large blood-clot. A very narrow, ragged, and contused strip of dura,

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<sup>1</sup> Read before the American Surgical Association, July 6, 1905

scarcely more than one-eighth of an inch in width, remained intact. The blood-clot was carefully sponged away and the bullet removed. The ends of the cord were then sutured with three fine chromicized catgut sutures, the dura being included in the sutures. No special difficulty was experienced in drawing together the ends of the cord and closing the defect, the latter representing in width the diameter of the .38-caliber bullet. The dura was further secured with a number of sutures of fine catgut, and a drain consisting of a half-dozen narrow strips of oiled silk protective introduced. The skin incision was sutured with silk-worm gut.

On May 30 the following note appears on the hospital record: "Wound healed, upper line of anæsthetic area from one and one-half to three inches lower than before operation. Twitching of toes of both feet and occasional clonic muscular spasms of the flexors and extensors of the thighs, the patient says his 'feet jump up on him'. Can feel when the bowels move, but is without control of the rectum. Can feel distention of the bladder with urine, but is without control" „

*Examination by Dr. William Browning on June 7*—It is found that no sensation can be definitely determined in the lower extremities which responds to any test, except where some muscular contraction occurs following motions producing pain, as spasm by jarring. There are frequent slight movements in the toes, these being noticeably present in the big toes. There is no cremaster jerk, the knee-jerk cannot be developed even by pulling down the patella. Ankle clonus is absent, Achilles jerk present on both sides. It is not certain that he can move either toe at will, occasionally he would appear to do so, but more often the motion would be in the other foot, in fact, there is so much spontaneous motion as to make what otherwise might appear to be a movement in response to the will purely accidental. Babinski's reflex in extension symptom (the upward jerk of the toes) is present on each side, there is also some upward motion of the toes on plucking out hairs on the front of each leg.

During July bed-sores developed on the buttocks and heels. These became quite deep, the sacral sore extending to the muscles. During November a cystitis developed, and irrigation of the bladder was done daily for about eight weeks, and urotropine, four grains every four hours, administered. Under this treatment the

cystitis improved. Patient was encouraged to sit up and go about in a wheel-chair, when the bed-sores healed rapidly. In January, 1904, a lobar pneumonia developed, from which the patient recovered without any untoward event. During the spring and summer of 1904 the sensation of the presence of the contents of the bladder and rectum was greatly improved. Occasional recurrences of cystitis were kept under control by irrigation and urotropin. Following the healing of his bed-sores he was treated by massage and electricity, and has taken daily walking exercises, assisted by an attendant, in a cage-like support resting on wheels, arranged somewhat like the "baby-tender" of the nursery. With the aid afforded by this support and braces to stiffen the knees, he manages to move about from place to place in the hospital.

During the winter of 1904 and 1905 his bladder and rectal sensations improved. He is now able to tell when a movement of the bowels is imminent, and at times is able to retain it for awhile. The same is true of the bladder. Erections are easily excited and persistent, but not painful. Both legs are spastic and quite useless for locomotion, except with the help of the apparatus above mentioned.

The following is a report of his condition in January, 1904, by Dr. F. C. Eastman, assistant in neurology at the Brooklyn Hospital.

*Sensation*—This is abolished in the legs and trunk as high as a line extending across the front of the body at a point one and one-half inches above the pubes, and in the back represented by a curved line about half an inch below the level of the iliac crests. Above this there is a zone of marked hyperæsthesia about two inches in width, though there is some irritability of the whole cord above the level of anæsthesia. There is an area about five inches in length extending down the outer side of the right thigh where there seems to be some sensation, but the patient is not able to correctly distinguish between heat and cold, nor is he able to correctly localize tactile sensations, which are usually referred to a point two or three inches distant.

*Voluntary motion* is completely lost in the affected area. There is loss of bladder and rectal control, the former at least acting automatically, the patient is able to tell just before the act that he is about to urinate.

*The abdominal and cremasteric reflexes* are lost. Virile and



epigastric reflexes present The knee-jerks are exaggerated, particularly the left The Achilles reflex marked, particularly on the right side Right Babinski reflex more marked than left Permanent right ankle clonus is absent on the left side Marked rigidity and spasticity of both legs Tendency to priapism Left leg one-quarter of an inch larger than the right Left thigh one-quarter of an inch larger than the right

*Trophic Changes*—Slight atrophy of both legs, probably from disuse Marked atrophy of gluteal muscles on both sides The muscles involved are apparently situated too far down for this atrophy to be the result of destruction of the cells of the anterior horn at the point of lesion, so that it may be simply from disuse, as these muscles atrophy more readily than any others in the body

The skin is somewhat dry and scaly, but there is very little trophic disturbance at the present time

Examination made by Dr Eastman on the 12th of June, 1905, shows the data to be practically identical upon comparison with the former report, with the following exceptions In the former examination it was stated that the anæsthesia extended upward in front to a point one and one-half inches above the pubes It is now found that the anæsthesia extends to the pubes and no further, the area of anæsthesia on the right leg and on the back, however, corresponds perfectly with the former findings There is no reaction of degeneration of any of the leg, thigh, or gluteal muscles

*Remarks*—The main points of interest in this case relate to the possibility of regeneration of the spinal cord following a destructive lesion Prior to the case reported by Dr F F Stewart and Dr R H Harte, in which the cord was sutured after it had been severed by a bullet, it was the opinion of the majority of investigators that such regeneration in man did not take place Mikulicz, of Breslau, endeavored to demonstrate the possibility of a successful regenerative process in the lower animals following section of the cord, but without result Spiller and Frazier found that after division of a posterior root in the dog, followed by immediate suture, regeneration occurs, and that regeneration into the cord does not occur

In comparing the result in the case reported by Dr Stewart with the conditions present in the case herewith reported, the following points are worthy of note. Sixteen months after the injury, in Dr Stewart's case, the patient was able to flex the toes, flex and extend the legs and thighs, and rotate the lower extremities. While in the sitting position she could raise the extended leg from the floor, and she was able to stand by supporting herself with her hands on the back of a chair. The bowels were under control except when diarrhoea was present, and moved every second day. The urine passed voluntarily amounted to about sixteen ounces in twenty-four hours, incontinence occurred during sleep. She had the sensations of touch, temperature, pain, and locality, the difference between heat and cold, however, was not always distinguished. Rigidity of the muscles was present in a moderate degree, both ankle clonus and patellar clonus were present on each side. Reaction of degeneration absent. No bed-sores had ever developed, and the skin and nails showed no trophic changes.

In the case herewith reported, the following is to be noted in comparison. Twenty-six months after the injury voluntary motion is practically lost in the affected area. He is able to stand when supporting himself by the hands resting upon an apparatus, and to make some locomotion by swinging movements in a special frame on wheels. The bladder and rectal control is doubtful, to say the least, the former acting automatically. He has the sensation that the bladder and rectum are about to empty themselves, and if the urinal or bedpan is brought to him promptly soiling is prevented. The amount of urine passed in this manner would probably average more than a pint in the twenty-four hours. Urine is sometimes voided during sleep. Sensation is practically abolished in the entire affected region, with the exception of an area about five inches in length extending down the outer side of the right thigh, where some sensation is present. He is not able to correctly distinguish between heat and cold. Tactile sensations are recognized, but are usually referred to a point two or three inches distant from the point touched. Marked rigidity and

spasticity of both legs are present Patellar reflex exaggerated, Achilles reflex marked Ankle clonus present on one side and absent on the other The reaction of degeneration is absent Upon this point, Dr Eastman reports as follows

“ I examined E ’s muscles as you desired, and can report that there is no reaction of degeneration of any of the leg, thigh, or gluteal muscles, further than that I cannot say positively I could not get the reaction in any of the muscles that I tried The trouble is that the back and abdominal muscles, which are supplied with nerves from the point of the lesion, are innervated from so many segments that lesion of any one segment does not destroy their activity, and then I could not react at all some of the muscles in the deeper layers of the back ” Bed-sores developed in the third month, these extended to the muscles and were six months in healing The skin shows but slight, if any, evidences of trophic disturbance

An important comment is suggested in comparing these cases, namely, the Stewart-Harte case was operated on three hours after the injury, while in the present case upward of ten days had elapsed before consent to interfere operatively was obtained The prolonged separation of the divided ends of the cord and the presence of the foreign body had, in all probability, an influence in preventing a complete regeneration of the cord, as occurred in the first case, provided, of course, that regeneration does actually occur While the case in hand is therefore not as striking in many of its features as the Stewart-Harte case, it presents some points of interest, and for this reason is offered as a contribution to the literature of the subject

Finally, the influence exercised by the possible presence of undiscovered portions of the cord, or of nervous structure in portions of the dura remaining intact in these and similar cases, may be taken into account It may be that this takes place also in connection with injury of the cord occurring as the result of fracture of the vertebræ, and the varying end result of operative interference in different cases may be accounted for in a

measure by the varying extent to which a final nerve anastomosis may take place through the medium of uninjured portions of the dura. This suggests likewise the occurrence of a relatively efficient nerve anastomosis through the medium of branches of adjacent nerve-trunks having their origin respectively above and below the lesion, and this in turn to the possibility of still further enhancing this effect by operative anastomosis of the nerve-trunks themselves. This, of course, assumes a relative limitation of the ascending degenerative process with elements of the cord as well as of the axis-cylinders of the divided and sutured nerve-trunks, and resulting innervation of the parts below the lesion and of those supplied by the injured segment of the cord, conditions not incompatible with those that may have been obtained in the Stewart-Harte case, and to a lesser extent in my own case.

# TUBERCULAR CONDITIONS OF THE SPINE RE- QUIRING SURGICAL AND MECHANICAL RELIEF<sup>1</sup>

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Of the tubercular and inflammatory conditions which affect the spine, the most common pathological process encountered is that mixed infection, tubercular and inflammatory, which is the result of spinal caries

The most prominent surgical measures employed for the relief of this condition are 1 Laminectomy for Paraplegia, 2 Forcible Immediate Straightening of the Kyphosis, 3 Forcible Gradual Straightening of the Kyphosis, 4 Erasion of Carious Bone, 5 Wiring of the Spinous Processes, 6 Evacuation of Pus Accumulations

1 *Laminectomy*—In the majority of cases, especially in children, the carious process may be arrested and a cure effected by rest, hyperextension, and fixation of the diseased area for a long period of time, yet in a certain number of instances a deposit of tubercular material within the spinal canal, enveloping and pressing upon the spinal cord, produces partial or complete paralysis of motion and sensation Following this tubercular deposit an ascending or descending pachymeningitis may result, with permanent thickening of the membranes sufficient to interfere permanently with nerve transmission Pus formation may still further interfere with function Added to the pressure already alluded to may be bony pressure from caries of the vertebral bodies, thus angulating the canal, and in some instances narrowing the caliber by actual bony encroachment In 98 per cent of the cases, however, the

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<sup>1</sup> Read before the American Surgical Association, July, 1905

diminution of caliber and the interference with nerve transmission are due to the first-named causes, while in only 2 per cent is compression due to bony pressure. This fact is readily appreciated when it is noted that some of the worst cases of spinal caries paraplegia are those in which the kyphosis is moderate or even small, and again that paralysis is absent in cases of most marked posterior angularity. The region of the spine most prone to yield the paraplegic complication of spinal caries is the upper dorsal, where the bony canal is limited in size, and where even a small amount of intraspinal deposit yields most serious consequences. The clinical experience of every surgeon, however, has taught him that even a severe grade of paraplegia may recover, although great angularity still exists, provided the tubercular and inflammatory deposits are absorbed. The amount of paralysis and the consequent symptoms will depend upon the position, extent, and character of the tubercular deposit. A child affected with spinal caries begins suddenly or slowly to show evidences of feeble locomotion, loss of sensation, increased knee-jerks and ankle clonus, rigidity of limbs, gradual contraction of some group of muscles, frequently, loss of control of sphincters of bladder and rectum, sometimes priapism, persistent and painful. Fifteen or twenty years ago the exceptionally good results secured in a few cases by Macewen, Horsley, Lauenstein, and others, encouraged us to hope that in laminectomy we had found a speedy method of relief. Unfortunately, larger and fuller personal experience has demonstrated that while a few cases are permanently benefited by operation, yet that the mortality is high, and, even when temporary improvement takes place, relapses were common and permanent benefit uncertain.

The operation, therefore, while it has not been abandoned, has, like trephining of the cranium for epilepsy, been limited in its application and made secondary to other measures. Those measures have for their object the arrest and lessening and limitation of the bony destructive process and the permanent bridging and repair of the destroyed vertebral bodies. Added to these should be the employment of all the hygienic

measures available. Among the latter it is unnecessary to say that sunlight and fresh air hold the first places. In my experience, the prognosis in spinal caries paraplegia under so-called conservative methods has been so successful that I hesitate, save in very exceptional cases, to recommend operative procedures until other measures have failed. Thorough and complete rest, fixation of the diseased area, and progressive forcible straightening have yielded such good results that I have now many cases walking the streets which for a period of more than a year seemed incurable. I am inclined to prolong the treatment even to two years, when signs of improvement are evidenced. Of course, to be effectual, the rest should be absolute, the diseased vertebræ being so fixed that motion of the diseased bones is reduced to a minimum. This can be accomplished by head extension in bed, by hyperextension upon a Bradford or Goldthwaite frame, by plaster of Paris, or other fixed dressing to the spine. Internally, the iodide of potassium and iodide of iron are helpful, but rest and fixation are the prime elements in the cure. Should the paralysis continue beyond eighteen months or two years, the removal of the laminæ may, however, assist in the relief of the paraplegia, especially when the cord can be cleared from tubercular deposits. The mortality is unfortunately so high that after many years of test I find myself resorting less frequently than formerly to laminectomy for caries paraplegia, while in traumatism of the spine I am more and more convinced of the benefit of early interference. When the vertebral bodies are carious, a laminectomy removes the only remaining healthy portion of the vertebræ, and to a considerable extent weakens the column. The advantage of laminectomy is that it removes pressure from structures each fibre of which is necessary for vital function, while in the brain, individual cells are not so essential. Although asepsis has greatly diminished the dangers of the operation, yet in a certain number of cases laminectomy opens the way for spinal infection, and the results of the pachymeningitis remain or are increased. Fortunately, the pachymeningitic deposit in some cases will be found localized and can be removed.

If the bony angulation with pressure in front of the cord were the chief cause of the loss of motion and sensation in the lower extremities, it would certainly be wiser to push our operative results to a greater degree, even to the extent of severing the spinal nerves in order to reach the source of trouble in front of the cord and then to reunite these nerves. An immediate mortality of 25 per cent is very high, especially in a disease which is not in itself necessarily fatal, particularly as this rate is augmented during the first month by other deaths reaching more than one-third. If to this mortality be added those late deaths that are not directly the result of the operation, yet follow within a year, we find that at least in one-half of the cases life has been shortened. Final results following laminectomy are exceedingly difficult to obtain, since caries is a disease in itself, one that has to be judged by years not months, and an early report is valueless. The published reports would indicate that 65 per cent may reasonably be placed to the credit either of deaths or of not having been materially or permanently improved. Naturally, however, these patients were all serious cases at the time of the operation.

A few words in regard to technique. Incision to one side of the dorsal median line, the cutting off of spinous processes and pushing them to one side, lessens hæmorrhage. Hæmorrhage and the removal of the first laminal arch constitute the delays in the operation. Many hæmostats and very hot packing should be at hand. Many surgeons prefer cutting bone forceps for taking away the first arch, I use either gnawing forceps or a Hey's saw. The fatty tissue and the ligament subflava are at first confusing, but as soon as the cord is exposed all hesitancy disappears. If the dura is yellow, there is probably pus within the membrane. A surgeon who has performed the operation only once or twice upon the upper portion of the spinal column realizes but little the difficulties and dangers of the procedure in the lower column. One danger of the operation is that blood leaking into the canal may cause additional compression and paralysis by travelling down the subdural space. Postmortems show that similar extravasations of blood



may take place on the cornua or on the columns, producing further paralysis. After secondary degenerations have taken place, improvement in the paralysis is not to be expected. One of the great dangers of laminectomy, especially low down, is the risk of later infection from bed-sores or from pus sinuses. The neuropathic bed-sores are especially dangerous from the extent of the trophic changes, while leakage of infected and decomposing urine is also most serious. Laminectomy is much less hopeful in spinal caries than in fractures and other traumas, since pachymeningitis, compression myelitis, or meningomyelitis may all be present in the former. All undue handling, even sponging of the cord, adds to the shock. The cord may be rolled to one side, but any extensive bone erosion is to be accomplished from the side, not across the cord space. If nerve-roots are injured, they should be sutured. When the extradural deposit is considerable and its removal possible, the dura should not be opened, as any fissure in this membrane is liable to permit tubercular infection within the membrane. To sum up, then, the dangers of laminectomy are its high mortality from shock and hæmorrhage, infection, suppuration, extension of myelitis or pachymeningitis, failure to permanently relieve, and weakening of the column. The advantages are the removal of tubercular masses in the canal, the removal of pachymeningitic deposits and of pus, the relief occasionally of anterior bony pressure, and, lastly, allowance for posterior expansion. In some instances marked benefit results both as regards motion and sensation. Relief of vesical symptoms alone well repays

2 *Forcible Immediate Straightening of the Kyphosis* — The method of immediate forcible straightening of the spine by hand pressure, as revived by Calot, the patient lying prone with pelvis and shoulders elevated upon blocks, is simply a new form of the barbaric methods practised before the time of Hippocrates. In those days a man's feet were bound to a ladder, and he was then dropped head downward from the top of a building. In other cases a long beam was used as a lever, with the kyphotic spine as the fulcrum, by which method,

of course, it was easy to crush any amount of deformity into the straight line Hippocrates states that this method was employed "by those physicians who seek to astonish the mob and never give themselves any concern as to the result of the procedure, whether good or bad"

Looking at the operation both pathologically and clinically, it is unsurgical and unscientific Upon its revival, I preferred that other surgeons should try it rather than myself, and I have never had occasion to change this opinion I have resorted to the procedure a few times in old hopeless cases, but the operation has died the death to which it was entitled To break up an already ossified bridge and leave a carious gap certainly is not conducive to the strength of a column, if pus is present, infection is probable It has been shown pathologically that the material thrown out in the process of repair does not contain sufficient calcium salts or bone-producing material to give proper strength to the new bone Since a cure can only be expected by an ossifying osteitis and a fixation of the spinal column capable of sustaining the superincumbent weight of the shoulders and head, the effort aimed at should not be, as in the immediate forcible operation, to produce a gap in the front of the spine which experience has shown can never be fully filled, but to secure as large an amount of ossifying material as possible and a bridge of most secure pattern While the muscles may for a time hold the spine in position, they must ultimately give way, and relapses commence after the removal of the support

Cases in which advantage has been secured in the relief of paraplegia are undoubtedly where the cord pressure has been relieved by the altered straightening of the column the disadvantages are insufficient support causing weakness of the spine, subsequent recurrence, dissemination of tubercular material, increase of disease by local injury, production of general tuberculosis, injury to the cord, fresh suppuration In some cases the paraplegia has been rendered worse, and in one instance the wall of the abscess was ruptured sufficiently to admit tubercle bacilli into the mediastinum

3 *Gradual Correction of the Deformity*—Forcible hand pressure upon the kyphosis at varying periods or by using the hump as a fulcrum and bringing to bear upon it the weight of the body above and below the disease, is a much safer process than immediate fracture. The advantages gained by such straightening must be immediately fixed by the application of a plaster-of-Paris cast. By this method a small amount of gain is secured, but all that is justifiable or to be expected safely. It is undoubtedly true that a large proportion of so-called straightening of the spine is due not to actual improvement of the kyphosis, but to the alteration of the curves in other portions of the column. In forced lordosis, bringing the weight of the body upon the posterior region rather than upon the vertebral bodies, is probably a large element in the benefit secured. This is true whether suspension is used or whether the dorsal fulcrum is applied directly to the kyphosis. The recumbent position upon a curved frame and extension in bed with a pad under the kyphosis during the acute stage is the best method of preventing deformity, then fixation for a long period of time by some form of splint adapted to each particular region of the spine, that is, in the cervical region the head should be thoroughly splinted, not by suspension or by a jury-mast, but by prolongation of the steel uprights so as to hold the head firmly in position with rigid splints. In the upper dorsal the same method is necessary, in the lower dorsal or lumbar either a steel or leather or similar jacket may be employed. Success depends upon the careful and long continuance of retention appliance for a sufficient length of time to produce a strong bony bridge. With the screw elevation shown in Fig 1, the kyphosis and the spinal column are forced into hyperextension while the gypsum is applied. The plate over the hump is protected by a large, loose, felt cloth pad, which remains. Before the plaster fully hardens, a slit is made over the plate, which latter is so hinged that it can be withdrawn through a small opening. This opening can be closed at once by patching with plaster. A muslin suspension sling answers a similar purpose (Fig 2).

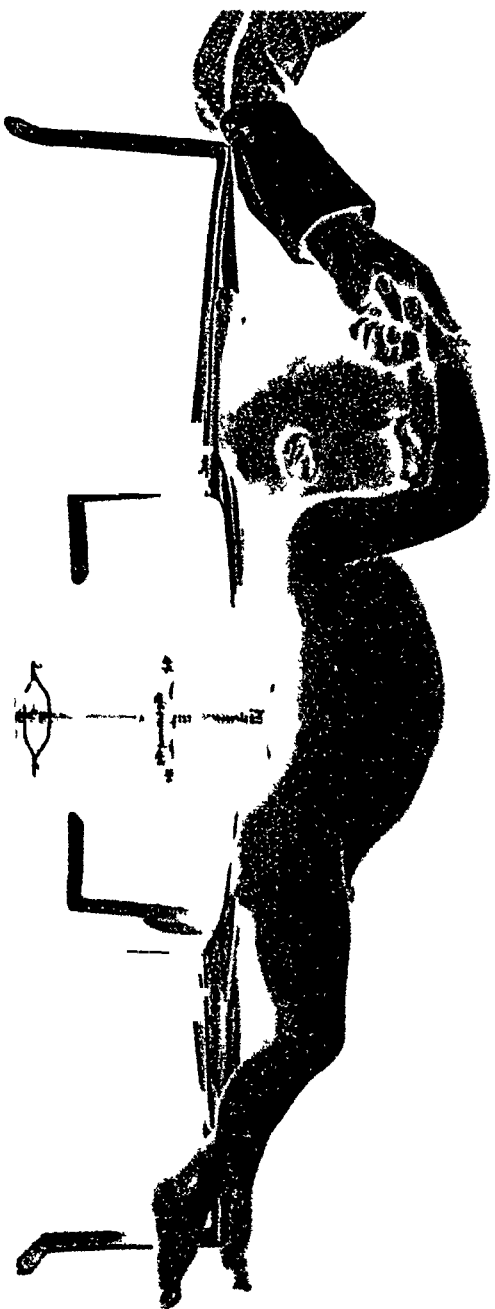


Fig. 1.—Screw upright for straightening kyphosis while plaster of-Paris bandage is being applied for permanent fixation in hyperextended position. Plate is hinged, so as to be withdrawn flat through slit.



4 *Erasion of Carious Bone*—Theoretically, the operation of erasion is a good one, practically, the anatomical difficulties encountered are well-nigh prohibitive to that absolute removal of all carious tissue which is so essential to a complete and rapid diminution of pus formation. Of course, as long as we have any dead bone remaining, the discharge will continue. If the disease were situated principally or simply in the posterior regions, of course removal would be easily accomplished, but since it is the bodies of the vertebræ that are chiefly diseased, the absolute removal of all diseased tissue is problematical. The bodies of the lumbar vertebræ are large

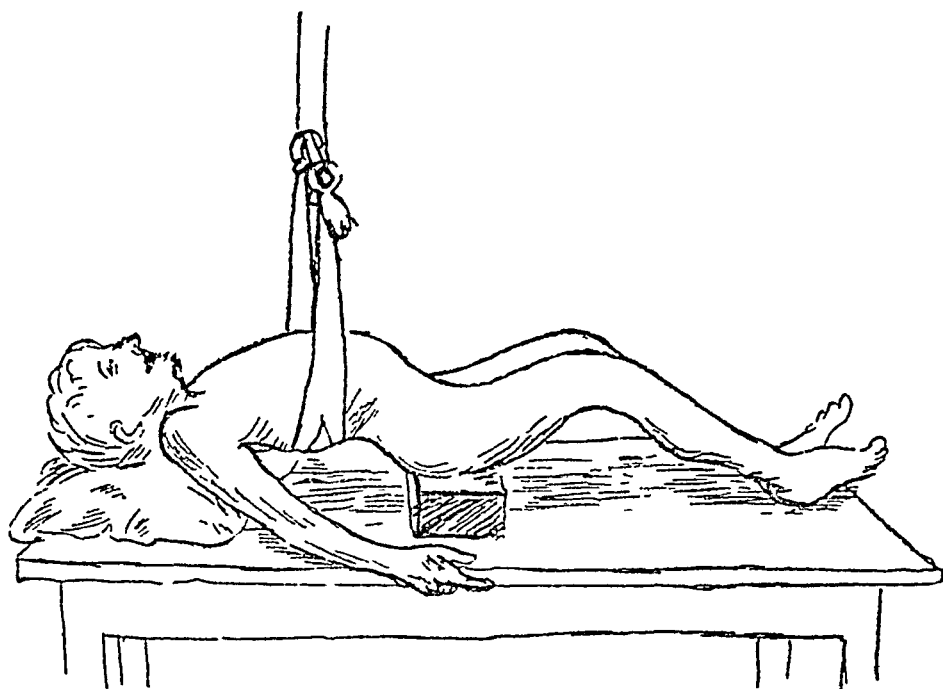


FIG 2—Muslin bandage for temporary suspension during application of gypsum (Bradford)

and lie far from the surface of the body, a careful inspection is impossible, and manual palpation fails to discern diseased bone from the roughened surfaces left by a gouge in cancellous tissue. One has but to examine a cross-section of a body as seen in formalin or frozen sections to note the difficulties of completely reaching and removing the entire body of the vertebræ even in a cadaver. In the dorsal region still greater difficulties are encountered. To reach the bodies, portions of

ribs must be excised, a costotransversectomy, the pleura lies in close proximity, and the wounding of this membrane opens new avenues for infection. The operation of erosion in this region is only applicable in cases where a large intrathoracic abscess has pushed the pleura forward and where manipulations can be conducted from inside the sac, a condition difficult to diagnose in advance. The twelfth dorsal can be reached from below through the psoas, but it should be remembered that the pleura is close at hand, sometimes extending as low as the liver and the transverse processes of the first lumbar. In the cervical region, a certain amount of diseased bone may be removed, but seldom all. In all these regions, therefore, the results are uncertain. The X-ray may assist in locating the disease, but even taken in connection with clinical symptoms is not positive. In the lumbar region too long an operation is not advisable, as the multitude of muscles, tendons, and strong fascia render the operation difficult, bloody, and uncertain. The immediate risks of the operation are considerable. To a certain extent, however, the suppurative process may be shortened by the amount of dead bone removed, the chief advantage gained is drainage.

5 *Wiring of the Spinous Processes*—Wiring of the spinous processes as a means of inducing fixation of the column has been occasionally used, but not with sufficient frequency to determine its usefulness. Theoretically and mechanically the method seems only fairly helpful.

6 *Evacuation of Pus Accumulations*—Surgeons vary in their methods of dealing with pus accumulations from spinal caries. Some still insist that cases progress more rapidly if the abscess is permitted to remain quiescent and to be absorbed or encapsulated. In some instances such a result is undoubtedly possible, but it is risky and usually unsuccessful. My own practice is to aspirate such accumulations so long as the liquefaction of caseation is drawn, but when the suppurative process is added to the tubercular, asepsis through drainage from spine to groin is best, provided subsequent cleanliness can be secured, a result which is undoubtedly possible with the exercise of constant vigilance.

## CONCLUSIONS

1 Complete methodical and long-continued fixation of the spine in the position of hyperextension, with healthy surroundings in the sunlight, are the prime factors in securing new ossific deposit necessary to replace the carious bone

2 Laminectomy for paraplegia is advisable only after long-continued and patient treatment along the above-named lines from one to two years, since the prognosis, especially in children, under these conditions is favorable, and good powers of locomotion may be confidently expected The operation is justifiable in selected cases where loss of motion and sensation are progressively worse and the symptoms threaten life If the tubercular masses within the spine can be removed, and if extradural pachymeningitic deposits or pus can be taken away, improvement may be expected, and in many cases relief occurs The operation has a mortality of about 25 per cent from immediate shock, 36 per cent within a month, while one-half the cases die within the year, their lives being probably shortened by the operative procedure Cases of non-improvement and death equal nearly 65 per cent

3 Forcible immediate straightening of the kyphosis is an unsurgical and dangerous proceeding, it is liable to reawaken the tubercular disease and to weaken the column

4 Forcible gradual straightening by supporting the kyphotic area upon a pedestal is a valuable agent in relieving deformity The weight of the shoulders and pelvis can thus be utilized as straightening forces and the weight of the column thrown upon the posterior arches In this position it is permanently fixed by plaster of Paris

5 Complete erosion of the carious bodies of the vertebræ is an uncertain operation, in the dorsal region requiring section of ribs, with danger of wounding the pleura

6 Wiring of the spinous processes has never been sufficiently tried to demonstrate its helpfulness

7 Spinal abscesses which contain only liquefaction of caseation should be aspirated When true pus has formed, aseptic through drainage is advisable



# THE SURGICAL TREATMENT OF INTRASPINAL TUMORS<sup>1</sup>

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AMONG the many fields of surgical activity which owe their present advanced state largely to the labors of physicians, few have owed so much in the past or still owe so much to them as that of spinal tumors, although to a surgeon—von Leyden (1874)—is due the first suggestion of an operation for the amelioration of the symptoms produced by this disease. Nor, I think, would any surgeon presume at the present day to perform laminectomy for a suspected intraspinal growth without consulting a neurological colleague, even were the surgeon himself capable of diagnosing and of accurately localizing the tumor. It is therefore not the purpose of the present paper to treat at length of the symptoms and diagnosis of these affections, it is quite sufficient to recall briefly the salient features which would in the case of any patient suggest to the surgeon a neurological consultation.

Pain is usually the symptom first complained of, and is generally of a rheumatic or neuralgic character, localized to one limb, or to certain of the intercostal nerves. It is frequently more or less completely relieved temporarily, but persistently returns, and constantly grows more severe. To the pain is next added—often, however, not for some years—a numbness and heaviness in one or more of the limbs. The symptoms are almost invariably unilateral at first, but with equal constancy become bilateral before paresis has fully developed. Girdle sensation, with a zone of hyperæsthesia immediately above the limit of the anæsthetic area, is also usually

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<sup>1</sup> Read before the American Surgical Association, July, 1905

observed Early in the course of the disease the affected limbs are spastic, but later the reflexes are lost, and in time the muscles lose their reaction to the Faradic and to the galvanic current as well The loss of certain of the sensations, as those of heat and cold, while others are retained, considered characteristic of syringomyelia, is also sometimes observed in tumors pressing on the spinal cord, and several instances are known where operations, undertaken for the removal of supposed spinal tumors, have relieved, at least temporarily, the syringomyelic symptoms by the evacuation of the cystic collections found in this disease Local physical symptoms of a tumor are usually absent, such symptoms, for example, as deformity and rigidity of the spinal column, or tenderness on pressure over the site of the tumor, but when such symptoms are present, they are of course a considerable aid in diagnosis, when tuberculous caries of the spine can be excluded

The science of spinal localization is now so well developed that it usually is not difficult to determine with accuracy the location of an intraspinal growth, and since multiple growths are exceedingly rare, the chances for successful removal of a spinal tumor would be overwhelmingly favorable did success depend upon localization alone But besides this factor we must also consider the inherent difficulties of the operation, the nature of the tumor, and its relation to the membranes of the cord

In searching the literature for reports of operations for tumors of the spinal cord, a number of cases have been found which do not strictly come under this classification What is usually understood by the term tumor of the spinal cord is an extramedullary but intraspinal growth like a sarcoma, a fibroma, or a myxoma, giving no evidence of its existence except by the symptoms of medullary pressure which it produces Thus, tumors of the spinal column—osteomata, enchondromata, or sarcomata, which are palpable externally, and are readily diagnosed by an ordinary physical examination—should not be included unless by extension into the vertebral canal they produce medullary symptoms Cases of pressure

on the cord due to traumatism or to tuberculous caries of the spine are also of course excluded. But I have included in my tables certain cases in which, although there were present external symptoms of the growth, there was nevertheless no direct connection between the two. For instance, a case reported by Curtis, in which laminectomy was done for spinal involvement secondary to carcinoma of the breast, has been included, although such extension of malignant growths is not very unusual,<sup>\*</sup> and such cases do not strictly belong to the class of intraspinal tumors. No cases have been included, however, in which laminectomy was a mere incident in the removal of a growth extending into the spinal canal, but in which it was an operation not intentionally undertaken to relieve the symptoms of spinal irritation.

There have been found records of 92 operations for spinal tumors, among which number 43 patients died,—a total mortality of nearly 47 per cent. McCosh has stated (*Journal of the American Medical Association*, 1901, 11, 621) that the mortality of laminectomy *per se* should not be more than 10 per cent, and if from the percentage above given we omit those cases, 17 in number, ultimately known to be fatal, but in which death ensued some weeks or months after the operation, we can reduce our mortality to 26 cases, or 28 per cent. Even with a mortality of nearly 30 per cent, it does not seem to me that the surgeon should hesitate to operate in these cases, since, even when a cure cannot be obtained, relief from the pain is almost invariably secured, and the patient in most instances lives as long as he would have done if no operation had been performed.

The nature of the tumor is recorded in 88 of the reported cases. It was sarcomatous in two-fifths of the whole number (37 cases), † adhesions, thickenings, etc., hold second place,

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\* C. N. Dowd (New York Medical Record, 1898, 1, 347) collected histories of twenty-nine cases of mammary carcinoma, in five of which there had been distinct symptoms of involvement of the spine.

† Of Schlesinger's 400 cases of spinal tumors, one-quarter was sarcomatous.

with 11 cases, then comes echinococcus, 8 cases, fibroma, 6 cases, syringomyelia, 5 cases, endothelioma, 4, psammoma, 3, cyst, 3, fibromyxoma, 2, osteoma, 2, and one each of myeloma, lipoma, lymphangioma, dermoid cyst, primary and secondary carcinoma, and one tumor of bone whose nature is not stated. In only three instances where the patient recovered from the operation did no improvement follow it. Two of these were cases of inoperable sarcoma, and the third was a case of syringomyelia. The annexed table shows that of those patients, 49 in number, who survived the operation for some weeks or months, no less than 29, or 59 per cent, recovered their functions sufficiently to be classed as cured, that 17, or 34 per cent, could be classed as improved by the operation, while in the condition of only three patients, or 6 per cent, as mentioned above, did the operation effect no change.

Variety of Growth	Total	Died	Recovered		
			Cured	Im- proved	Not Im- proved
Sarcoma	37	20	8	7	2
Adhesions, etc	11	5	4	2	0
Echinococcus	8	3	5	0	0
Fibroma	6	2	3	1	0
Syringomyelia	5	2	0	2	1
Endothelioma	4	2	1	1	0
Psammoma	3	1	1	1	0
Cyst	3	0	2	1	0
Fibromyxoma	2	1	1	0	0
Osteoma	2	0	2	0	0
Tumor of vertebra	1	1	0	0	0
Myeloma	1	0	0	1	0
Lipoma	1	1	0	0	0
Lymphangioma	1	0	1	0	0
Primary carcinoma	1	1	0	0	0
Secondary carcinoma	1	1	0	0	0
Dermoid cyst	1	1	0	0	0
Not stated	4	2	1	1	0
	92	43	29	17	3
			49 Recovered		

In discussing the sarcomata recorded here, it may seem audacious in the extreme for a surgeon to mention such a thing, but it does not seem impossible to me that in some

instances the microscopical diagnosis may be in error. It certainly appears from this table, where 17 out of 37 sarcomatous patients are reported as having recovered from the operation, that sarcomata of the spinal canal do not possess that extreme malignancy which characterizes them in other parts of the body. When three such patients are reported as in fair health at a period of more than six months after the operation, and five are said to be well at the end of from two and a half to five years after the operation (of which latter cases two patients, surviving more than four and five years respectively, had intradural sarcoma), it makes one very sceptical as to the reliability of histological diagnoses. Some of these cases are reported as having an infiltrating sarcomatosis, practically inoperable, yet, after cautious curettement of the external surface of the diseased dura, no recurrence is noted even when years have elapsed. Cushing's case is reported frankly enough as one in which reasonable doubt existed as to the diagnosis between fibrosarcoma and fibroma, and McCosh likewise states that, in view of the subsequent history of his patient (no recurrence after two and a half years), it is probable that the tissue removed at operation was granulation tissue and not sarcomatous in character. But other observers, especially the German surgeons, do not seem to have been struck by this point. We all know with what melancholy regularity sarcoma recurs in amputated stumps and in extirpated glands, but when it occurs along a man's spinal marrow, it seems that we may expect its removal to insure against recurrence in nearly or quite half of the cases.

I have included in the table twelve operations where symptoms of spinal tumor were produced by meningeal thickenings or adhesions. In at least five of these cases (Macewen's) the patients had suffered from Pott's disease of the spine in previous years, and a kyphosis still remained, but no tuberculous process was found at the operation, and with Starr's tables (*American Journal of the Medical Sciences*, 1895, ciii, 613) of spinal tumors as my authority, I have thought it proper to include them with tumors rather than among cases

of laminectomy for spinal caries I have myself recently done the operation of laminectomy on a patient with old Pott's disease, in whom no active bone disease was found, but in whom the paralysis appeared to be due to extradural thickening, and not to actual compression from the angulation of the spine

CASE I—*Paraplegia from Pott's Disease, Laminectomy, Great Improvement*—Harry S., aged twenty-six years, was admitted to the Orthopædic Hospital, Philadelphia, September 5, 1904. There was no tuberculous family history obtainable. The patient had had pneumonia at two years, scarlet fever at five years, and diphtheria at seven years of age. In 1896, when nineteen years old, he had typhoid fever, which was complicated by phlebitis in both lower extremities, the right being the first affected. After about three months of convalescence his legs ceased to swell. In 1898 he entered the army, and fell and struck his left knee-cap. The injury was not severe, but there was much swelling and a good deal of pain. For this condition he was admitted to the Pennsylvania Hospital, June 29, 1898, under the care of the late Professor Ashhurst. The diagnosis was tuberculous arthritis of the left knee. In July some iodoform emulsion was injected into the joint. In August an abscess, apparently tuberculous in character, formed on the inner middle aspect of his right arm. This was opened and drained. In September, 1898, the patient was discharged from the Pennsylvania Hospital, walking with crutches. Six months later, in May, 1899, he returned to the Pennsylvania Hospital for examination, and was under my care. His limb was in good condition, and he had a fairly useful knee. He was allowed the use of his leg. After this date he states that the abscess on his arm opened again, and that his shoulder became stiff. In 1901 he was again admitted to the Pennsylvania Hospital, and the knee-joint was found so badly diseased that it was thought impossible to further pursue conservative treatment. Dr. Barton Hopkins accordingly amputated the left thigh in its lower third. The patient made a good recovery from the operation, and returned to his home in Harrisburg. Not long after this date he noticed a hump the size of a hickory-nut in the lower dorsal region of his spine. He complained chiefly of pains in the lumbar region, and was treated for lumbago. He was not seriously incommoded, how-

ever, until June, 1904, when he suffered from what he describes as remittent fever, being confined to bed for two weeks. When he got out of bed, he noticed that a numbness which he had felt for some months around his hips had increased, and also that his foot was numb. He very soon lost the use of his body and limbs below the waist-line.

On admission to the Orthopædic Hospital, in the autumn of 1904, he was paralyzed from the waist down, and sensation was markedly impaired throughout the affected area. He had retention of urine and a severe grade of cystitis. The stump of his amputated left thigh was in good condition. There was very marked kyphosis in the lower dorsal region. Extension was applied to his head and right leg, and measures were adopted to relieve the cystitis. Sensation improved somewhat, the cystitis was finally cured, and the patient regained control of his bowels and bladder. He also became able to flex the great toe occasionally, and by contracting his abdominal and psoas muscles he could barely move both thighs. He remained in this state for many months, and, as no further improvement seemed probable, the question of laminectomy arose. He was examined by one of the neurological staff, who advised against any operation. Nevertheless, on April 27, 1905, nearly eight months after his admission, laminectomy was undertaken, the patient being willing to undergo any operation that offered him even the remotest chance of improvement. A cure was not anticipated. The spines and laminae of the ninth, tenth, and eleventh dorsal vertebrae were removed, and some extradural thickening dissected out. Practically no shock attended the operation, and on recovery from the anæsthetic the patient expressed himself as being able to feel the bed under him in a much more real way than he had done before. He said he no longer felt dead below the waist. Gradually increasing power in the great toe developed, and at the end of four weeks sensation was perfect all over the lower extremities, all the toes could be freely moved, the ankle-joint could be flexed and extended at will, the knee and thigh could be raised from the bed, and the amputated thigh could likewise be moved. Before the operation, when one or two movements of the great toe had been made, all power was exhausted, and no further motions could be made for some hours. Now he can move his muscles at will all day long.

With very few exceptions, it is impossible to determine the nature of the tumor before operation. Gummata may nearly always be excluded, they are very rare in the spinal canal, and it is never worth while to delay operation for the sake of trying antisyphilitic treatment. According to Starr (*Journal of the American Medical Association*, 1901, 1, 202), only twenty-six gummata were found in a series of 400 cases of tumor of the spinal cord. Sarcoma can only be diagnosed with certainty when the spinal lesion is clearly secondary to similar disease elsewhere in the body. The only other tumors found which are frequently secondary in origin are hydatid cysts. Among the eight recorded operations for this condition, three were palpable over the spinal column, and one of these (Trendelenburg's) was reoperated after four months for recurrence.

In a case recorded by Hale White (*Transactions of Clinical Society of London*, 1900, xxxiii, 140), Fripp operated twice on a young man with spinal pressure from a dermoid cyst in the upper dorsal region. Although on the first occasion the growth was found to be inoperable, yet so much relief was experienced for a period of two months, that another attempt was made to relieve the patient, but unfortunately without success, as the case terminated fatally in eight and a half hours. This young man had suffered from Hodgkin's disease for a number of years, but it was clear, even before the first operation, that the spinal pressure was unconnected with that condition. In the autumn of 1904 I operated on a case of dermoid cyst of the spine, and, although there were no symptoms of involvement of the spinal cord, I desire to place it on record.

CASE II—*Dermoid Cyst of the Spinal Canal, Operation, Recovery*—E. T., a girl, aged seven years, was admitted to the Episcopal Hospital, Philadelphia, August 31, 1904, under the care of Dr. H. C. Deaver. She presented a diffuse swelling over the sacrum, cystic and semifluctuating to the touch, and extending well over to both buttocks. This condition had existed since birth, and had been considered a spina bifida. A few days be-



fore admission she had been struck over the tumor. A small abscess formed, and was opened September 13, 1904, being apparently superficial, and not connected with the spinal tumor. She was discharged from the hospital on September 22, but was readmitted on October 3, coming then under my care, with high fever and evidences of infection of the spinal growth. After appropriate local and general treatment, which caused subsidence of the constitutional symptoms, it was determined to attempt the removal of the spinal tumor, which produced great deformity in the child, as well as interfering with her sitting comfortably on a chair. Accordingly on October 21, 1904, I dissected the cyst out, finding it adherent to the coccyx and the lower sacrum. Part of the coccyx was removed. The wound healed uneventfully though slowly, and the patient was discharged, cured, February 2, 1905. The appearance of the growth at operation was typical of dermoid cyst, and the pathological report confirmed the diagnosis. "The section is undoubtedly tissue from a dermoid tumor in which the connective tissue predominates. There are small areas of epithelial structures, such as serous glandular tissue and extensive areas showing mucosa and submucosa, with solitary follicles and agminated lymph-glands. There are numerous blood-vesels and scattered foci of hæmorrhagic infiltration, considerable fatty tissue, little smooth muscle, but no voluntary muscle." \*

It has usually been stated that extradural tumors were much more frequent and much less fatal than intradural growths. I do not find this to be the case, however. There are 87 cases in which the situation of the tumor with regard to the dura is mentioned, in 50 of these it was extradural, and in 36 intradural,—not such a very striking difference. The death-rate, moreover, in the extradural cases was even higher than that of the intradural tumors, being 50 per cent for the former and only 47·21 per cent for the latter. This may perhaps be explained by the fact that sarcomata are more frequently extradural than intradural (of 37 sarcomata 16 were intradural and 21 extradural), and that they are also more apt

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\* In connection with the subject of dermoid cysts of the spine, see an interesting article by Bland Sutton in the *ANNALS OF SURGERY*, 1889, 11, 81

when intradural to be circumscribed or encapsulated, and thus removable with little damage to the surrounding parts, whereas the extradural sarcomata are frequently infiltrating, and may involve the spinal column and surrounding muscles very extensively. Nevertheless, the danger attendant upon intradural operations must not be ignored, since we find that among these operations, all done with antiseptic or aseptic precautions, no less than six of the intradural terminated fatally from meningeal infection, whereas only one of the fatal extradural cases has meningitis recorded as the cause of death.

Malaisé (*Deutsch Archiv für klin. Med.*, 1904, lxxx, 143) has recently written an elaborate article on the diagnosis between intra- and extramedullary tumors of the spinal cord, but in no case reported to-day was it possible to tell before operation the relation of the growth to the dura, much less the fact whether it was in the substance of the cord or not. In only two of these cases (except, of course, those of syringomyelia) was it found at operation that the medullary substance was involved in the growth. These were Fenger's case of spindle-celled sarcoma and Warren's case of endothelioma. The former terminated fatally on the fourth day from septicæmia, but Dr. Warren's patient was in good health more than one year after the operation.

It is interesting to note that among female patients the mortality of operation has been only 45 per cent, while among the male it is 57 per cent. In searching for an explanation of this marked difference, I have noticed that sarcomata were found one-third oftener in males than in females, and suppose that this fact may have something to do with lessening the mortality among women.

Most of the operations were on adults, nearly one-half being between thirty and fifty years of age. The extremes of life were nine years in a boy and sixty-five years in a woman. Those patients under twenty and over fifty gave the highest percentage of recoveries.

The average duration of symptoms before operation was two years and three months. In 12 patients symptoms had

existed for less than six months, in 11 for one year, in 8 for one year and a half, in 12 for two years, in 11 for three years, in 7 for four years, and in 6 for periods varying from four to eighteen years. The duration of symptoms does not, unfortunately, throw much light upon the nature of the tumor, since I find that the average duration of symptoms in the patients with sarcoma was two and three-quarters years, in those with adhesions two and three-quarters years, in those with echinococcus two and one-half years, and in those with fibroma one and a half years, while in all other forms of growth the average was about two and one-eighth years.

A history of injury is noted in only five cases,—three sarcomata, one each a psammoma and an endothelioma.

Of 82 cases in which the region of the spine affected is given, the upper dorsal region was involved in 33 cases, or over 40 per cent, the tumor was found in the lower dorsal region in 24 cases, in the lumbosacral region in 14, and in the cervical region in 11 cases. As far as the results are concerned, it appears to be immaterial at what level the growth is found.

The cause of death is given in 28 cases. One-half of these were due to shock and hæmorrhage, or to infection and meningitis, there being 7 fatal cases under each of these categories. Eight patients died from exhaustion, three from recurrence of malignant growths, two from hypostatic pneumonia, and one from bed-sores and sepsis.

As regards the technique of the operation, it is essentially the same as when employed in traumatic cases. The patient lies in the prone position, with a sand pillow or other firm support beneath his shoulders and upper chest, so as to raise the diaphragmatic region somewhat away from the table, this position facilitates the operation by rendering the respiration of the patient less labored, as well as by making the spine more accessible. As has been repeatedly demonstrated at operation and autopsy, the inclination of the surgeon is to search for the growth too low down in the spinal canal. Horsley says it may be expected to be found four inches above the

upper limit of the hyperæsthetic zone. In the cases tabulated in this paper, the growth was not found in five, and in three of these it was proved, either at a second operation or at autopsy, that it could have been easily removed at the first attempt had the exploration of the spinal canal been carried higher. Some surgeons have advocated beginning the laminectomy some distance above the supposed location of the growth and then working downward, thinking that the wound would heal better thus than when the spine was explored from below upward, because by the latter procedure the parts divided have their nerve-supply impaired by the more highly situated lesion. But it seems to me that it is much more in accord with surgical principles to begin our operation where we expect to find the tumor, and to subsequently search the spinal canal higher up, if we fail to find the compressing structure where it is believed to be.

The incision should be made on the tips of the spinous processes, and should be amply large, to expose at least three vertebræ. I have never employed osteoplastic resection of the arches, known in Germany by Urban's name, and do not think it is a good form of operation. Sonnenburg condemns it, and attributes the death of one of his patients from meningitis on the eighteenth day to the presence of the retained bones. Nor do I think the plan advocated by Abbe (*New York Medical Record*, 1890, 11, 85) a commendable procedure. This surgeon makes his incision one-half-inch to the side of the spines, then chips them off just below the interspinous ligament, and turns them back with the soft parts as a flap on the other side of his wound, and then proceeds to do his laminectomy. For my own part, I think it better to cut right down on the spines, and then clear the laminae on each side with the scalpel and periosteal elevator. The bleeding during this process is always free, and can only satisfactorily be controlled by packing. Hæmostatic forceps will not hold in the fibromuscular tissues of the spinal gutters. It is most convenient, therefore, to pack one side temporarily while the other is being cleared, and then to pack the second side and return to complete the clearing of the first. By this means little blood is lost, and by the time the

spines and laminæ are cleared the bleeding will have nearly ceased, without the employment of forcipressure, and without the application of a ligature. I have not found transverse division of the spinal aponeurosis at each end of the incision necessary to facilitate the retraction of the flaps, but it may be employed, if preferred.

In the dorsal region, where the spines overlap each other, the next step is to cut off two or three spines at their base with large Butcher's knife-bladed forceps. It is impossible to insert a forceps between the laminæ until the spines are out of the way. When this is accomplished, it may be possible to bite through the bases of the laminæ, next the pedicles, with large knife-bladed forceps. The blades should be set nearly at right angles with the shaft, the angle being on the edge, as in bandage scissors, not on the flat, as in the ordinary curved scissors. If such forceps are not at hand, or if they cannot be made to bite through the laminæ, I prefer to apply a crown trephine to the base of one of the spinous processes, and thus open the spinal canal. The trephine should be at least a half or three-quarters of an inch in diameter. When the canal has once been entered, the opening may be enlarged with rongeur forceps. I do not think the use of chisel and mallet (a gouge is safer) advisable, as a rule, but have at times found them useful in trimming off the ragged margins left by the rongeur forceps.

Hæmorrhage from the spinal veins may be controlled by gauze packing or by Horsley's wax, which should always be at hand.

The condition of the dura should next be examined. A considerable amount of connective tissue may overlie it, and removal of this alone may be sufficient to relieve all symptoms, if no other cause of compression can be found. The dura should pulsate, and normally bulges somewhat into the wound, occluding the extradural space at the limits of the opening made into the bony canal. It is well to be quite sure that no extradural cause for compression exists before proceeding to open the membranes, since the risks of producing meningitis are thus considerably increased. Horsley's dural separator is, I think, the most convenient instrument to use in exploring the

spinal canal beyond the limits of the wound Krause (*Deutsch med Woch*, 1903, xxix, Ver-Beil, 321) uses a thick sound to explore when the tumor is not found immediately beneath the opening in the spinal canal If nothing can be detected by means of cautious exploration in this manner, the dura may then be opened in the median line The incision should be made with a scalpel hitherto unused in the operation, and the same precautions to avoid injuring the cord are to be used that we employ when opening the peritoneal cavity to guard against injury of the intestines The opening first made should be small, and the escape of the cerebrospinal fluid, which may prove a veritable flood, should not be allowed to take place too rapidly No alarm need be felt at the quantity of this fluid evacuated, since, so far as I am aware, no evil results have been known to follow the plan usually adopted, of letting it run until it stops of its own accord In an operation on the cervical region, Woolsey (*New York Medical News*, 1904, 11, 625) packed the subdural space at the upper end of the wound with gauze, to check the flow of cerebrospinal fluid before the operation was proceeded with, and he mentions the plan adopted by Schede of encircling the cord above and below the seat of operation with an extradural temporary ligature, but most surgeons have not been forced to adopt such measures to check the ooze

The opening in the dura is then to be enlarged with scissors to the full extent of the laminectomy wound, and the search for the tumor continued Almost invariably the tumor, whether intra- or extradural, is found to one side or other of the cord, and nearer its posterior than its anterior surface, but if it is not detected in these situations, the anterior surface of the cord may be cautiously explored with an aneurysm needle

If a cyst is found it should be punctured, and, especially in the case of hydatid cysts (which in all the cases here recorded were extradural), great care should be taken to prevent spread of infection As a rule, the intradural tumors are found to be more or less encapsulated, and may be removed with only trifling hæmorrhage

If no tumor can be found in the region of the spinal cord

exposed, the surgeon should not hesitate to remove the spines and laminae of three, four, or five of the vertebræ higher up. The chances of an error in diagnosis having been made are much less than those of failing to find the tumor through timidity of exploration. Of course, in these, as in all other cases, the extent of the operation must be governed largely by the condition of the patient, and in case of collapse of the patient the operation should be temporarily abandoned, and concluded after a day or two, if possible, when reaction has occurred, as was done in one case by McCosh, with the result that the tumor was found and removed at a higher level than that exposed at the first operation. Where no cause for the symptoms can be found, it is at least possible to divide the posterior roots of the affected nerves, and thus promote euthanasia.

If the dura has been opened, it should be sutured, if at all, very loosely. These patients have done much better when the drainage of cerebrospinal fluid after the operation has been free. Fine catgut is better than silk for the dura as it is less liable to cause a persistent sinus. Drainage with gauze down to the dura should, I think, be employed in every case. The wound of the soft parts is extensive, and the traumatism will have been considerable, unless free exit is given to the wound discharges suppuration is quite apt to ensue. The gauze may be removed on the fourth or fifth day, or as soon as the patient is able to bear the necessary disturbance. The spinal aponeurosis should be brought together with buried sutures of chromicized catgut, and the skin should be approximated with interrupted sutures of silkworm gut, but not too closely applied.

After the operation no rapid improvement in the patient's condition need be anticipated, indeed, the paralysis and the anæsthesia are sometimes markedly aggravated by the interference with the spinal nerves. But the pain is nearly always remarkably relieved, and the patient is in a more hopeful frame of mind than before the operation.

The after-treatment should be the same as in every serious operation. Calomel and Dover's powder, as in head injuries,

will be beneficial to obviate the tendency to restlessness and wakefulness. The period of rest in bed must vary somewhat with the strength of the patient and with the extent of the operation. Some patients can be allowed to get out of bed in less than a week, but, as a rule, they should maintain the recumbent position for from three to five weeks. When the patient first gets out of bed, his back should be supported in a spinal brace or a plaster cast, and for the partial paralysis of his limbs, which sometimes persists, such orthopædic appliances should be ordered as may be required.

## LIST OF CASES ANALYZED

- Abbe *Journal of Nervous and Mental Diseases*, 1903, *xxx*, 103. Variety of growth not stated, recovered.
- Abbe *Thorburn, Brit Med Jour*, 1894, *i*, 1403. Syringomyelia, no improvement.
- Abbe *Starr, N Y Med Record*, 1890, *ii*, 85, Case 6. Sarcoma, died.
- Abrahamson *Journal of Nervous and Mental Diseases*, 1903, *xxx*, 102. Not stated, died.
- Anderson *Ransom, Brit Med Jour*, 1891, *ii*, 1144. Echinococcus, died.
- Barclay *Clark, Brain*, 1895, *xviii*, 256. Endothelioma, died.
- Bottomley *Munro, Jour Amer Med Assoc*, 1904, *ii*, 1183, Case 8. Adhesions, improved.
- Bruns and Kredel *Archiv f Psychiat*, 1896, *xxviii*, 97, Case 1. Neurolog Centralbl, 1894, *xiii*, 281. Sarcoma, died.
- Bruns and Lindemann *Archiv f Psychiat*, loc cit, S 133, Case 2. Neurolog Centralbl, loc cit, S 389. Sarcoma, died.
- Caselli *Riforma Med*, 1893, *iv*, 380. Osteoma, recovered.
- Chipault *Dejerine and Spiller, Comptes Rendus de la Soc de Biol*, Paris, 1895, 10<sup>e</sup> Serie, *ii*, 622. Sarcoma, died.
- Crofts *Horsley, Clin Jour*, London, 1896-97, *ix*, 183. Syringomyelia, improved.
- Curtis *N Y Med Record*, 1898, *i*, 346. Secondary carcinoma, died.
- Cushing *ANNALS OF SURGERY*, 1904, *i*, 934. Fibrosarcoma, recovered.
- Davies-Colley *Trans Clin Soc of London*, 1892, *xxv*, 163. Sarcoma, recovered.
- Davis, George G. *Jour Amer Med Assoc*, 1904, *i*, 751. Sarcoma, no improvement.
- Deaver, J B. *Lloyd, J H, Amer Jour Med Sc*, vol *xcvi*, p 564. Adhesions, died.
- Elliot *Putnam, J J, Amer Jour Med Sc*, 1899, vol *cxxviii*, p 385, Case 3. *Journal of Nervous and Mental Diseases*, 1903, *xxx*, 665, Case 1. Sarcoma, great improvement.
- Elliot *Putnam, J J, Journal of Nervous and Mental Diseases*, loc cit., Case 2. Carcinoma, died.



- Elliot Putnam, J J *Journal of Nervous and Mental Diseases*, loc. cit, Case 3 Fibrosarcoma, died
- Eskridge and Freeman *Phila Med Jour*, 1898, 11, 1236 Fibroma, recovered
- Eskridge and Rogers *Ibid*, 1898, 1, 332 Tumor of vertebræ, died
- Faure Hirtz and Delamere, *Bull de la Soc Med des Hop*, Paris, 1902, 11, 308 Endothelioma, died
- Fenger Church and Eisendrath, *Amer Jour Med Sc*, 1892, vol ciii, p 395, Case 6 Spindle-celled sarcoma, died
- Fripp White, Hale, *Trans Clin Soc of London*, 1900, xxxiii, 140 Dermoid cyst, died
- Gerster N Y *Med Record*, 1890, 11, 131 Putnam and Warren, *Amer Jour Med Sc*, 1899, vol cxviii, p 388, Case 9 Sarcoma, died
- Gerster Sachs, N Y *Med Record*, 1900, 1 7, Case 2 Fibrosarcoma, improved
- Graff Schultze, *Mittheil a d Grenzgeb d Med u Chir*, 1903, xii, 153, Case 7 Fibroma, much improved
- Graff *Ibid*, loc cit, Case 9 Fibromata, died
- Hahn *Deutsch Zeit f Chir*, 1902, lxiii, 421, Case 1 *Centralbl f Chir*, 1902, 11, 399, Case 1 *Berlin klin Woch*, 1902, xxxix, 645, Case 1 Echinococcus, died
- Hahn *Deutsch Zeit f Chir*, loc cit, Case 2 *Centralbl f Chir*, loc cit, Case 2 *Berlin klin Woch*, loc cit, Case 2 Echinococcus, recovered
- Hahn *Berlin klin Woch*, loc cit, Case 3 Osteoma, recovered
- Hahn *Deutsch Zeit f Chir*, loc cit, Case 5 *Berlin klin Woch*, loc cit, Case 4 Syringomyelia, died
- Hartley Fraenkel, *Journal of Nervous and Mental Diseases*, 1903, 11, 101 Fibrosarcoma, died
- Horsley Gowers, *Trans Med-Chir Soc London*, 1888, lxxi, 377 Fibromyoma, recovered
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- Horsley *Clin Jour London*, 1896-97, ix, 182 Echinococcus, recovered
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- Lennander Henschen, *Upsala Lakaref Forhandl N F*, Bd vi, p 453, abstracted in *Centralbl f Chir*, 1902, 11, 935 Schultze *Mittheil a d Grenzgeb d Med u Chir*, 1903, xii, 209 Fibrosarcoma, recovered

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- Macewen Ibid, loc cit, Case 4 Adhesions, died
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# STUDIES IN THE SURGICAL ANATOMY OF THE SMALL INTESTINE AND ITS MESENTERY

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THE "Studies" herewith reported concern that part of the small intestine which extends from the end of the duodenum to the ileocæcal valve, and which is known to anatomists as the "jejuno-ileum"

About two years ago I began certain investigations on the cadaver for the purpose of determining whether, when a loop of small intestine appears in an abdominal wound, there is any means by which the surgeon may get an approximate idea as to the part of the intestine which the loop occupies. After a careful examination of the gut and its mesentery in a large number of subjects to see if there were any points about the intestine or its mesentery which might serve to differentiate one part of the tube from the rest of it, a series of tests was conducted through various abdominal wounds on the cadaver for the purpose of finding out with what degree of success this information could be practically applied. To this process I gave the name, "Intestinal Localization." The results were sufficiently gratifying to justify me in thinking that the process was a practical one, and that it might be useful on the living subject. I therefore reported the results of these investigations to the American Surgical Association at the Annual Meeting, May, 1903 †. While I was working on the subject of intestinal

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\* The Mutter Lecture for 1904, delivered at the College of Physicians of Philadelphia, December 2, 1904

† They were published in the Transactions of the Association, and also in the ANNALS OF SURGERY for October, 1903. Since making this report, I have had good reason to believe, both from my own experience and from that of other surgeons who have kindly communicated their results to me, that the method may be of great use on the living subject whenever

localization, I noted incidentally certain other directions in which investigations might be made with a fair promise of good results. I therefore conducted a new series of studies on the cadaver, this time, however, more in reference to such points of general surgical interest as might develop in the course of the work than to the subject of intestinal localization. In these studies \* I was most efficiently assisted by Drs W E Faulkner, D D Scannell, and W C Howe, as well as by several other physicians, and it gives me pleasure to acknowledge here my indebtedness to them.

The studies, which are necessarily somewhat fragmentary, are embraced under the following headings:

1 The length of the intestine, as measured from the end of the duodenum to the ileocaecal valve

2 The length of the mesentery, as measured from the mesenteric root to different parts of the intestine

3 The distance to which the different loops of the intestine may be drawn downward in the median line towards the pubes, results of tests

4 Relative functional value of jejunum and ileum, resection of portions of ileum

5 Demonstrations of the real shape of the mesentery

6 Disposition of the mesentery in the abdominal cavity

7 *The pelvic fold of the mesentery*, how to palpate it its use as a landmark

8 How to find the lower end of the ileum through an abdominal wound

9 Influence of the mesentery on the course of the intestine

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it is desirable for the surgeon to know quickly what part of the intestinal canal a given loop occupies

\*Of the material used in this work, a part belonged to the Surgical Department of the Harvard Medical School, the remainder was kindly furnished by the Anatomical Department of that institution, and by the Pathological Department of the Boston City and of the Long Island Hospitals. I wish here to thank Drs Thomas Dwight, F B Mallory, and G B Magrath, who represent the last three departments mentioned, for their courtesy in allowing me the use of it.

(a) Influence of the mesentery on short segments of intestine

(b) Influence of the mesentery on longer segments of intestine

(c) Kinks in the intestine

10 Course of the intestine as affected by conditions within the abdomen

11 Distention of intestines, experiments in the introduction and removal of air and water

12 The passing of instruments into an enterostomy opening

13 The determination of the real direction in a loop of bowel

14 Conclusions

The drawings were made from specimens, or from photographs, or from both

#### THE LENGTH OF THE JEJUNO-ILEUM

In the course of these investigations I made a number of measurements of the length of the jejunum-ileum, but, as similar measurements have already been made by a number of other investigators, I shall dismiss the subject in a few words. In thirty-one adult cadavers, of both sexes and of different nationalities, where the intestine was measured *in situ*, the average length was a little less than 23 feet (7.01 metres), the shortest being 14 feet (4.27 metres) and the longest 33 feet 10 inches (10.31 metres). All these measurements, with the exception of two, or possibly three, at the very beginning of the work, were made with a tape-measure, the intestine being *in situ*, and the abdominal cavity freely laid open from ensiform cartilage to pubes.\*

*Remarks* —Because of the fact that a long tube like the intestine, which can be so easily stretched, does not readily

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\* In twelve other cadavers, also of both sexes and of different nationalities, where the intestines were kindly measured for me by my colleagues and others, the same method being used, the average length was found to be a little less than that given above

lend itself to so exact a process as that of accurate measurement, and also because in the process of measurement so many other sources of error may enter, I am of the opinion that statements made in text-books and elsewhere aim at an exactness which the facts do not justify. The average length of the small intestine of the adult (measured from the end of the duodenum to the ileocaecal valve) is probably somewhere between 21 and 23 feet (between 6 and 7 metres). The fact that the intestine varies greatly in length in different individuals, interesting as it may be, does not, however, especially concern the surgeon, except that a long intestine means more loops and a more complicated arrangement of coils, and that from such an intestine greater lengths of ileum may be resected without danger of interfering with nutrition than from a shorter one.

In connection with this subject, it is well to bear in mind, where the intestine is measured *in situ*, the great difference between the length of the gut when the measurement is made along its free border as compared with that made along its attached or mesenteric border. Thus, in one case in my series, while the gut along its free border measured about 20 feet (6.10 metres), it measured only 15 feet (4.57 metres) along its mesenteric border, showing a difference of 5 feet (1.50 + metres) between the two measurements. The free border of the gut is therefore much longer than the mesenteric border, and the free border may therefore appropriately be called the "long side" of the gut and the mesenteric border its "short side."

#### THE LENGTH OF THE MESENTERY

On account of the usefulness in a general way of knowing the distance to which the various parts of the intestinal tube may reach in different directions within and without the abdominal cavity, I have measured the length of the mesentery at different distances down the intestine. The measurements were taken from the attachment of the mesentery on the pos-



FIG. 1.—Showing the method for determining the length of the mesentery at different points along the intestine (usually at every foot) from the end of the duodenum to the ileocaecal valve. One hand of the assistant is shown. His other hand held the ruler in exact contact with the mesenteric root but, for the sake of simplicity, this hand was omitted in the illustration. (Drawn from the endpaper and from a photograph.)





terior abdominal wall to the edge of the mesentery where it is attached to the intestine. The method I employed for taking these measurements—and this was done on twenty cadavers—is shown in the accompanying illustration (Fig 1).

*Results*—The results of these measurements show, as far at least as we can judge from twenty cases, that

(1) As a rule, the length of the mesentery gradually increases from the end of the duodenum up to the fourth or fifth foot of the gut, at which point it usually reaches its maximum. Occasionally it reaches its full length even earlier. Opposite the lower end of the gut, the length of the mesentery diminishes again, rather more abruptly than is the case opposite the upper end of the canal.

(2) Throwing out of consideration the upper and lower extremities of the mesentery, that structure varies, as a rule, from 5 to 7 inches in length (13 to 18 centimetres), the extremes being about  $4\frac{1}{2}$  inches and 8 inches ( $11\frac{1}{2}$  centimetres and  $20\frac{1}{2}$  centimetres) \*.

(3) Short mesenteries are usually short throughout and long ones usually long throughout, all, however, showing some variations in length in the course of the canal.

(4) As a rule, it may be said that the longer the intestine the longer the mesentery, and the shorter the intestine the shorter the mesentery, though there are marked exceptions to this rule †.

\* This result differs from that given by Treves, who says "The length of the mesentery from the spine to the intestine varies in different parts of the canal, its average length may be taken as between eight and nine inches." As my own measurements show the average to vary between five and seven inches, I can explain the disagreement only on the assumption that possibly, in speaking of the length of the mesentery, Treves included the width of the gut also, for, if this were so, the two averages would more nearly agree.

† In one intestine which measured 30 feet 8 inches (935 metres), at only one point did the mesentery reach the length of 6 inches ( $15\frac{1}{4}$  centimetres), while in another intestine, which was only 14 feet long, the mesentery measured 6 inches at several points.

THE DISTANCE TO WHICH DIFFERENT LOOPS OF THE  
INTESTINE MAY BE DRAWN DOWNWARD IN  
THE MEDIAN LINE

For the sake of determining roughly the relative mobility of the different parts of the small intestine in a downward direction, I have made a number of measurements on cadavers. These measurements rather suggest the probability that it must be unusual for a loop in the upper part of the tube to occupy a position in the lower part of the abdomen or in the pelvis. Conversely, as I have ascertained by drawing loops from the lower part of the tube upward, it is probably also unusual for one in the lower part of the tube to occupy a region high up in the abdomen. This general rule, to which, however, there may be occasional and marked exceptions, is of use in giving us a certain amount of information as to what loops we are most apt to meet through an incision in one or the other of these two regions.

Sixteen subjects in all were used, and in each subject a loop of intestine was drawn down at every foot, and the measurement taken. It was found more convenient and exact for purposes of comparison to take the measurements *upward* from the level of the pubic spine to the various loops as they were drawn downward one after another. The method used is shown in Fig. 2. The abdomen has been freely laid open from ensiform cartilage to pubes.

*Results*—Summarizing the results, I find that

(1) Taking the loops in succession, from above downward, each, as a rule, reached a little lower than the preceding one.

(2) A loop from the first foot of the jejunum could, on the average, be drawn to a point about 3 inches ( $7\frac{1}{2}$  centimetres) above the pubes. The extremes were  $\frac{1}{2}$  inch ( $1\frac{1}{4}$  centimetres) and  $4\frac{1}{2}$  inches ( $11\frac{1}{2}$  centimetres).

(3) In all but one of the subjects the pubes was reached by some part of the intestine. This usually did not occur before the tenth foot of the canal had been brought down.

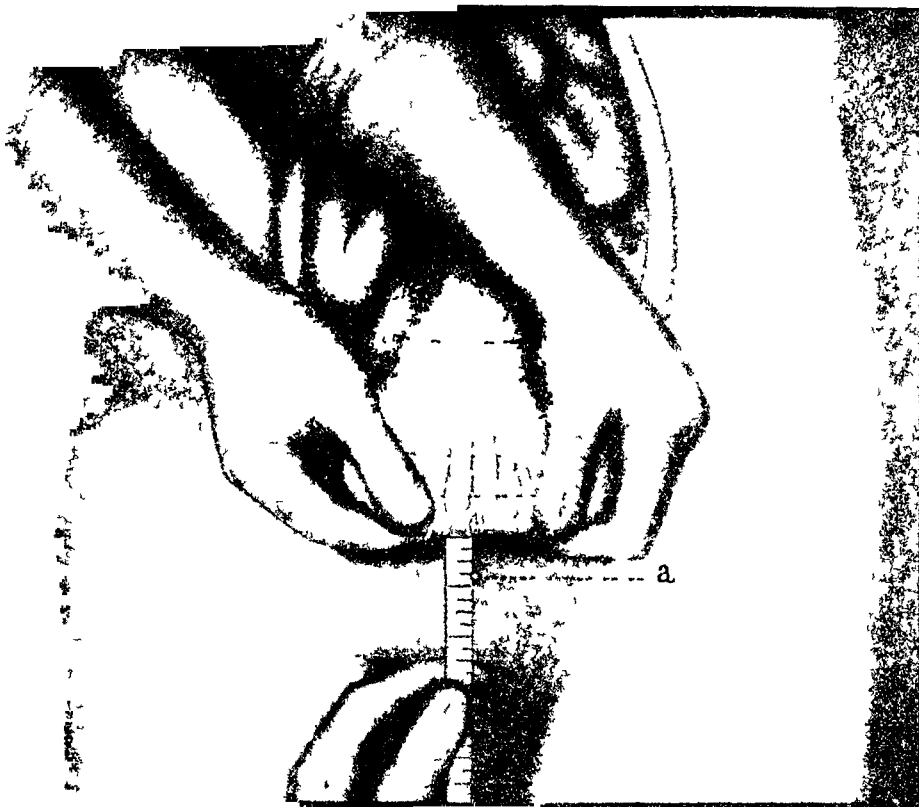


FIG 2—Showing the method of determining the point above the pubes to which a loop of small intestine will reach when gently drawn downward. The measurement is taken upward from the level of the spine of the pubes (a) to the free border of the intestinal loop. The dotted lines on the intestine and mesentery are arbitrary lines, indicating the levels of certain intestinal loops which do not reach so near to the pubes as does the loop shown in the illustration.



(4) As for the frequency with which the free edge of the intestine reached *below the pubes*, my measurements in these sixteen cadavers showed that in about two-thirds of the cases the free edge of some part of the gut reached a point which varied from 1 to 3 inches ( $2\frac{1}{2}$  to  $7\frac{1}{2}$  centimetres) below that landmark

#### RELATIVE FUNCTIONAL VALUE OF THE JEJUNUM AND ILEUM, RESECTION OF PORTIONS OF ILEUM

One can hardly fail to be impressed with the idea that the ileum, or at least the lower part of it, is apparently of less functional value than the jejunum. When one puts a coil from the jejunum beside one from the ileum and studies these two loops and the characteristics of the attached mesentery, one is struck with what seems to be the superior arrangement, for functional activity at least, of the upper to that of the lower segment of gut. The jejunum is usually thick and muscular, is filled with large and numerous valvulæ conniventes, and is evidently supplied with a great deal of blood, since the blood-vessels of the mesentery are large and straight and possess comparatively few branches. The ileum, on the other hand, is generally thin and flabby, and its valvulæ conniventes, if indeed there are any present, are smaller and less numerous than those of the jejunum, while the small, tortuous, and frequently branching vessels of its mesentery suggest a poor blood supply and a correspondingly low degree of functional activity. Judging from these facts, and from the numerous cases in which good results have been obtained after resection of appreciable lengths of the ileum, it may be assumed that a large portion of the lower part of the small intestine may, apparently, be sacrificed without detriment to health. I know of the case of one patient, a gentleman of thirty-three years, from whose ileum about three years ago nearly 8 feet (2.44 metres) of the tube was resected, recovery resulting.\* I know this gentleman

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\* This case was reported by George R. Harris, M.D. (of Norwich, Conn.), in the Medical Record, October 11, 1902.

personally, and I recently had a talk with him about his case. He said that he felt perfectly well,—better, in fact, than he had for years before the operation, that he was able to digest his food without discomfort, that he was no longer troubled with constipation and headache, which had formerly annoyed him, that he had lost no weight, and that he was quite as able to do his work (he is a sculptor by profession) as he had been before the operation. His only complaint was on account of occasional diarrhœa.\* Many other cases of resection of large portions of the ileum have recently been reported, usually with results which were entirely satisfactory.

From all this it would appear that the removal of a large portion of the ileum, for sufficient reasons, is perfectly justifiable, provided, of course,—and here is the danger in resecting large portions of an intestine,—that a sufficient length of intestine is left to carry on nutrition properly. In this connection, it is interesting to observe that the ileum, which, as far as we can now see, is the least valuable part of the small intestine, is far more frequently the seat of pathological lesions than is the jejunum.

#### THE REAL SHAPE OF THE MESENTERY, DEMONSTRATIONS IN SITU, THE TWO PORTIONS OF THE MESENTERY

The mesentery is a flat structure, whose root is about 6 inches ( $15\frac{1}{4}$  centimetres) long, and whose free border, which extends from one end of this root to the other, averages from 21 to 23 feet (6.40 + metres to 7.01 + metres) in length, while the distance from the base of the mesentery to its free border at any one point is usually not more than 7 inches (18 centimetres). It is clear that a satisfactory demonstration of such a structure *in situ* is not possible by the ordinary methods

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\* It occurred to me that perhaps this so-called "diarrhœa" might really be the result of the fact that the loss of so much absorbing surface necessitated the retention on the part of the intestinal contents of more than their usual amount of watery constituents.

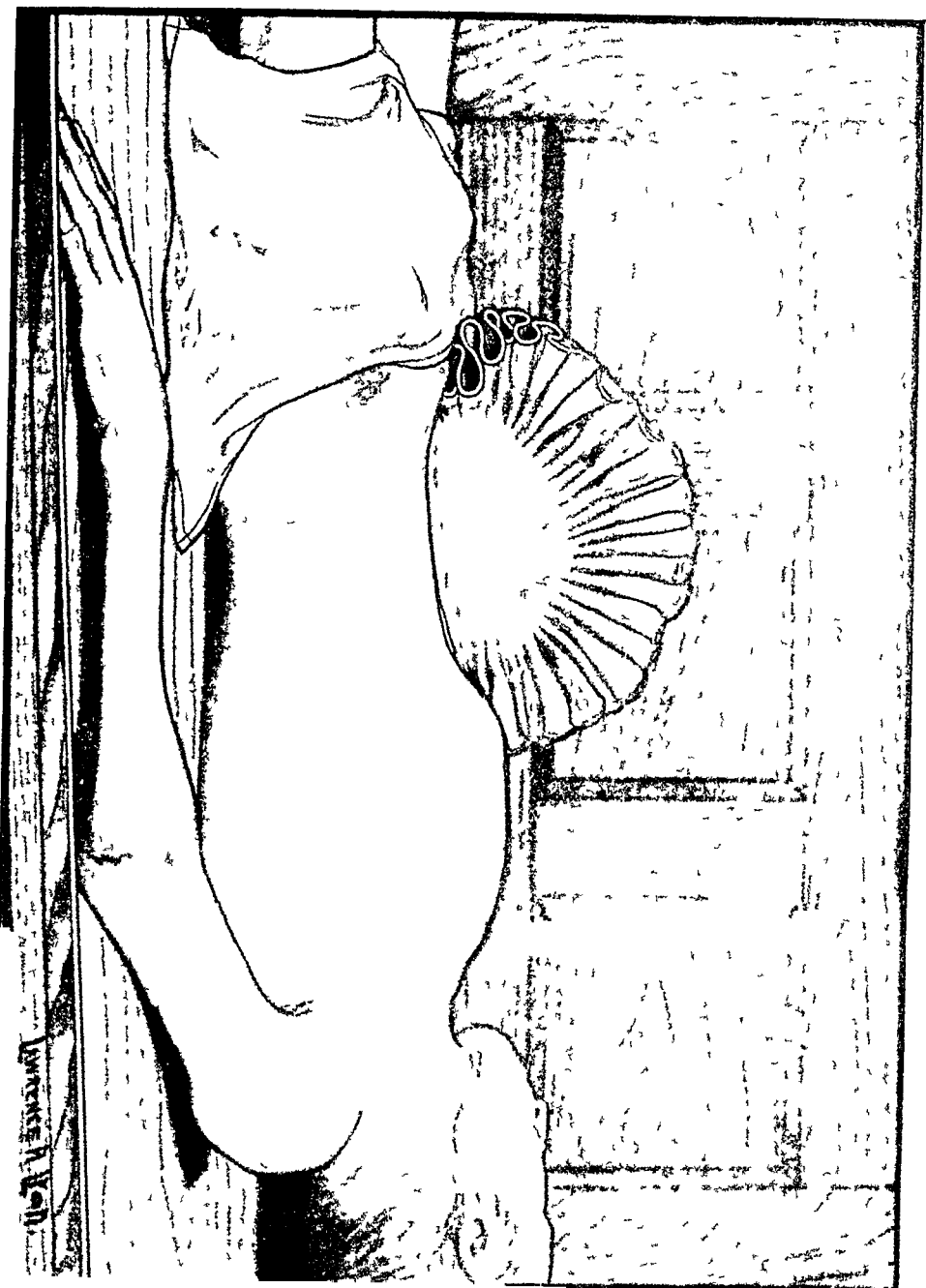


FIG 3.—Showing the intestinal tube thrown into alternate curves which are held in place by means of a stout copper wire within the gut. The alternating arrangement of the loops is most evident near the lower end of the ileum. The mesenteric is flit up to the place where the ruffled edge begins. (Drawn, with slight modifications, from a photograph.)



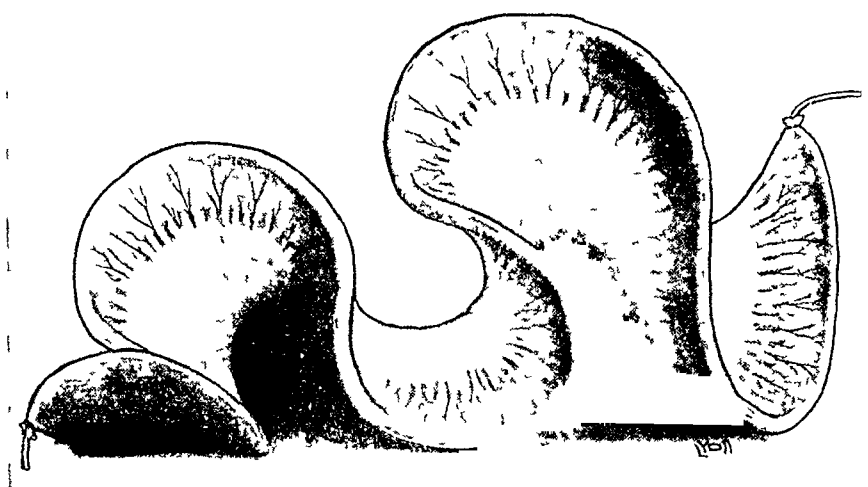


FIG 4—Showing *in situ* from above a portion of the intestine with its attached mesentery. It is thrown into large curves, and held there by means of a stout copper wire within the lumen of the gut (Drawn from the specimen and from a photograph )

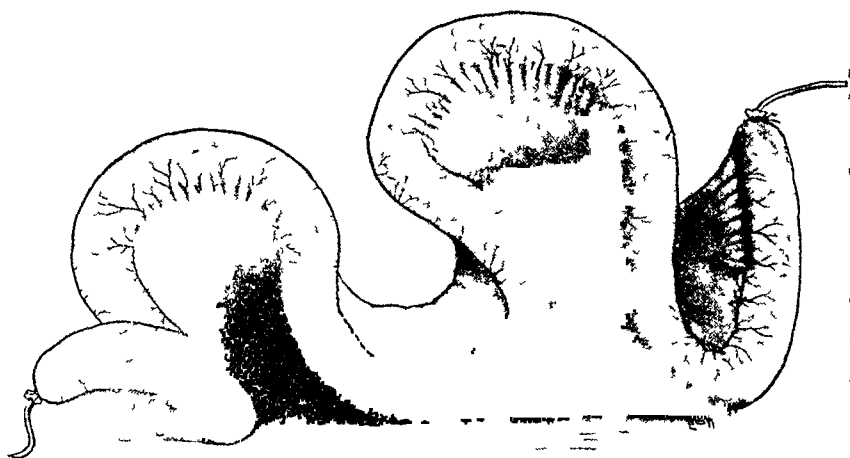


FIG 5—The same specimen shown in Fig 4 with the bowel somewhat inflated

In my paper on "Intestinal Localization" I tried to simplify its demonstration by introducing a small dowel into the lumen of the gut, about 8 inches (20 centimetres) from the ileocæcal valve, and, after "gathering up" the entire tube on it in the same way that an earthworm is drawn upon a hook, I caused the intestine and mesentery to assume a straight line. This can usually be done on intestines of moderate length and thickness where there is not too much fat in the mesentery.

By means of this contrivance I was able not only to demonstrate the entire mesentery and small intestine, but also, by turning the rod to the left or to the right side of the abdomen, to give an opportunity of inspecting and comparing the right and left fossæ of the abdomen with the greatest ease.

This demonstration, I thought, made the shape of the mesentery somewhat clearer, but still the folds in the distal parts of the mesentery and the gathers in the gut itself made it evident that it would be quite impossible to represent all the parts on the same plane. I therefore devised the scheme of running a stout copper wire through the intestine, bending it into continuous curves, which were made to alternate from one side of the mesentery to the other, in this way "taking up all the slack," as it were. I was able therefore to show simultaneously the whole of the mesentery and the intestine spread out without folds (Fig 3).

In Fig 4 another experiment with copper wire within the intestine is shown. Only a portion of the gut is here used. The point of view, being different from that in Fig 3, gives a rather better idea of the course of the intestine and the attached mesentery. The curves are much longer than those in Fig 3.

Another illustration (Fig 5) shows the portion of intestine and mesentery represented in Fig 4, the bowel having been distended with air.

From these demonstrations, it is quite evident not only that the distance between the two ends of the mesenteric root increases considerably the farther we take our line out on the

mesentery towards the gut, but also that this rate of increase, while gradual at first, suddenly becomes very marked after the ruffled border of the mesentery has been reached. In order to determine roughly, in figures, the rate of this increase, I made some measurements of the relative lengths of the mesenteric root, of the mesentery close to the bowel, and of the mesentery half-way between these points. In order to establish this middle line, I measured the length of a mesentery *in situ* at every foot of the intestine, in the manner already described, determining, however, at each foot of the intestine the point on the mesentery which indicated one-half of the distance between the root of the mesentery and its intestinal border. At each point thus determined I tied a knot of silk and cut off the ends. I then had a line of knots, running from above downward, exactly half-way out on the mesentery. I now measured the mesentery along these knots, proceeding carefully from one to another. I also measured the length of the root of the mesentery, and of the mesentery at its insertion into the bowel. The following are the figures.

Length of mesenteric root, 6 inches (15 centimetres)  
 Length of mesentery half-way between the mesenteric root and the intestinal border, 23 inches (58 centimetres)  
 Length of mesentery at bowel, 13 feet 8 inches (4.16 metres)

Expressed in other terms, which assume the length of the mesenteric root to be one unit, the measurement of the mesentery half-way to the gut was 4 units, and the measurement of the intestinal edge of the mesentery 27 units. These figures give an idea as to the enormous increase in length which takes place in the outer half of the mesentery. It does not require much inspection of the parts to realize that almost all of this great elongation really takes place in the outer one-third or one-fourth of the mesentery, that is, from the beginning of the ruffling of the mesenteric border. The mesentery, therefore, may well be described as consisting of two portions.

(1) *A proximal or flat portion*, comprising that part of the mesentery (about two-thirds or three-fourths of it) which

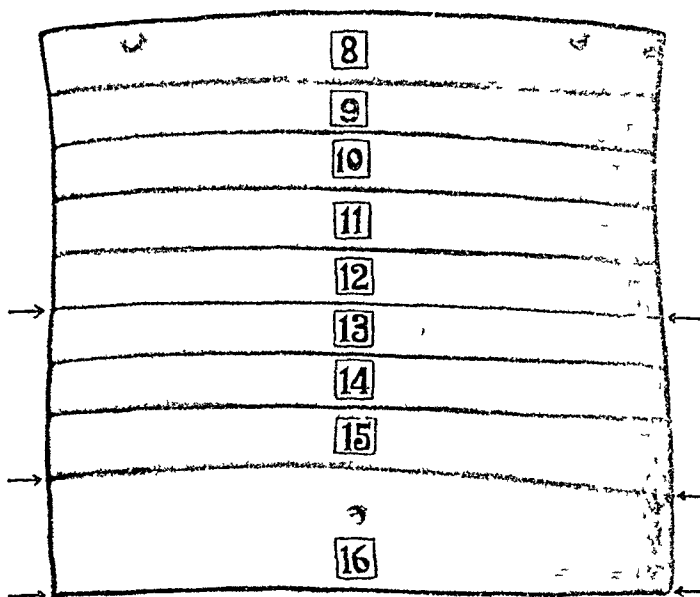


FIG 6—Showing *in situ* the sections of the trunk of an adult male. The two nipples and the umbilicus are the only landmarks. Arrows indicate the three sections to which reference is made in the text. (Drawn from a photograph of all the sections *in situ*.)

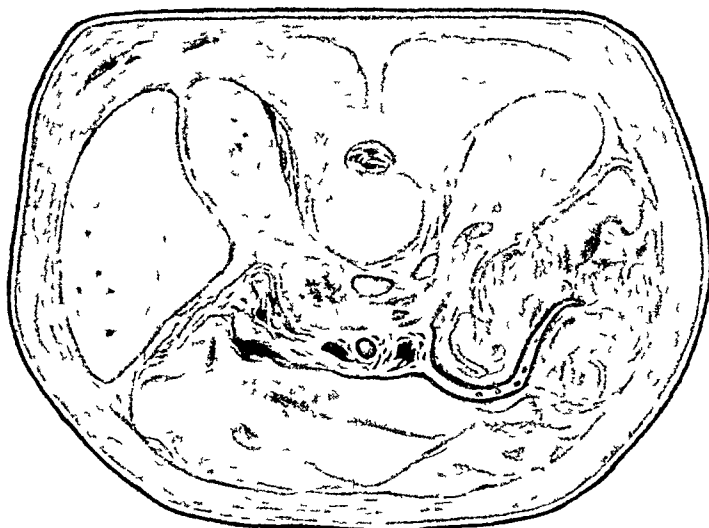


FIG 7—Showing the upper side of section No 13. The mesentery indicated here as in the other drawings by a thick white line, sweeps boldly towards the left side of the subject. (Drawn from the specimen.)

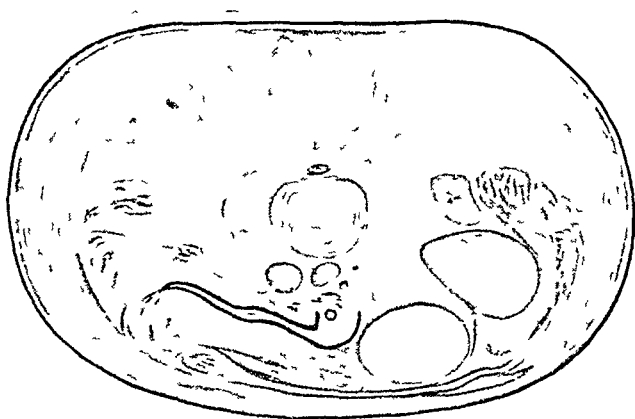


FIG 8—Showing the upper side of section No 16 which is cut slightly out of line. This section is at a level less than an inch above the umbilicus. The main sweep of the mesentery is towards the right side of the subject. Other sections of the mesentery appear at this level, but they are apparently distal portions from that part of the mesentery which rises higher up in the abdomen. (Drawn from the specimen.)

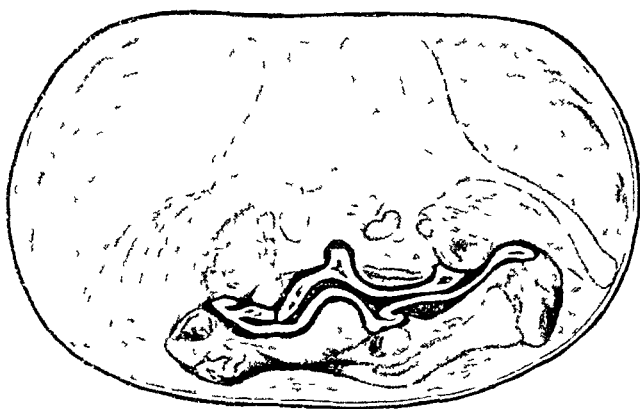


FIG 9—Showing the under surface of section No 16. Because of the fact that below this level the sections were cut vertically and many of the parts had therefore fallen out, the under surface of section No 16 was reversed so as to correspond with the drawings of the other two sections and it was therefore assumed that this reversed section represented the upper surface of what would have been section No 17 had the cutting of horizontal sections down the body been continued. This section is below the level of the lower end of the mesenteric root which end was easily found on the specimen by opening up the spaces. Several sheets of mesentery are here seen. They are very irregularly disposed and twisted, and, of course, correspond with the coils of ileum which descend into the iliac regions and pelvis. (Drawn reversed, as described above from the specimen.)

lies between the mesenteric root and the somewhat indefinite line where the ruffled border begins. This line might with propriety be called "the base of the ruffled border of the mesentery."

(2) *A distal portion, or "ruffled border"* (comprising the remaining one-third or one-fourth of the mesentery), which lies between the proximal or flat portion of the mesentery and the intestine

#### DISPOSITION OF THE MESENTERY IN THE ABDOMINAL CAVITY

Inasmuch as the length of the mesentery increases the farther out we remove our line from the mesenteric root, it is evident that, in order to accommodate itself to the restricted space allowed for it in the abdomen, the mesentery must be thrown into curves or folds. These folds must become more and more numerous the farther we remove our line from the mesenteric root. This tendency in the mesentery to assume the shape of curves or folds is repeated in the intestine in a manner which we shall see later. In addition to such investigations as I have been able to make on this subject on the ordinary cadaver, I have, realizing the great difficulty of getting accurate observations, carefully examined in reference to this point a series of frozen sections of a male adult, which belongs to the Anatomical Department of the Harvard Medical School, and, with the kind permission of Dr. Dwight, Professor of Anatomy, have reproduced three of them in which is emphasized the distribution of the deeper parts of the mesentery. Fig. 6 is drawn from a photograph of the body before the sections were taken apart, and Figs. 7, 8, and 9 show three of the sections, these being the only ones in which the mesentery could be distinctly made out. In order to understand these sections, it is best to imagine that the observer stands in front of the trunk, and that he looks down upon each section as those above it are removed.

While these sections belong to only one individual, yet the

evidence which an examination of them furnishes, so far as it goes, is of value, if only to illustrate the tendency of the mesentery to alternate in its direction, first to one side of the abdomen and then to the other. It is evident that in this individual the mesentery was first directed to the left, and lower down to the right. Below this its course cannot be clearly made out, but the third section shows two broad sheets in contact with each other, which extend from one side of the pelvis to the other.

Before leaving this subject, I should like to call attention to the fact that, as the sheets of the mesentery in the upper part of the abdomen leave their line of attachment at the mesenteric root in a direction more or less at a right angle with that root, these sheets are apt to be much flatter than those below, which, pursuing a course more or less parallel with the mesenteric root, show a much greater tendency to lie in folds.

#### THE PELVIC FOLD OF THE MESENTERY, HOW TO PALPATE IT, ITS USE AS A LANDMARK

That part of the mesentery which descends into the pelvis from the lower end of the mesenteric root can usually be felt distinctly by the examining finger. It is somewhat singular that no allusion, so far as I have been able to discover, is made in surgical literature to the fact that this part of the mesentery can be so easily palpated through a wound in the lower part of the abdomen. I have ventured to give to this fold the name, "the pelvic fold of the mesentery," and I think the fitness of this name will be evident to any one who hooks his forefinger around it. On numerous occasions I have felt this fold on the cadaver, and not infrequently on the living subject. It seems to me that it is of distinct use as a landmark, for, whenever we wish to enter the great fossa on the left side of the mesentery, we have only to push our finger around it. On at least six occasions I have guided the tip of the irrigating tube around it to the left side of the abdomen,

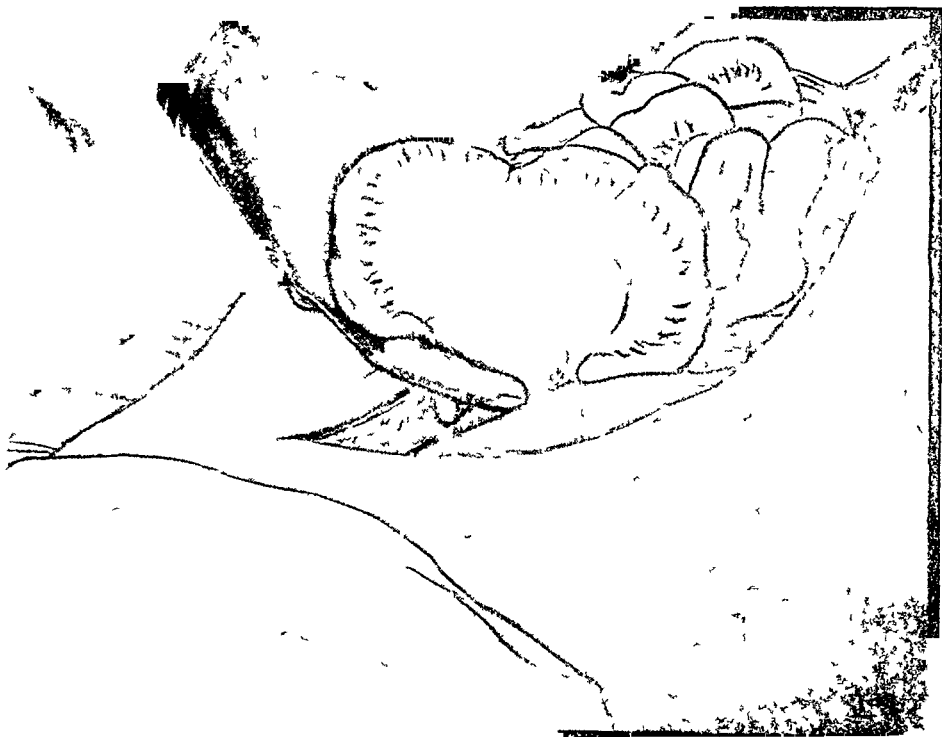


FIG 10—Showing the forefinger rounding the lower end of the ileum to reach the left side of the mesenteric root. The ileum and its mesentery are held up, so that the finger tip may be seen.





and have thus satisfactorily flushed out that great cavity. The cases in which this was done were cases of general peritonitis following appendicitis. The presence of this "pelvic fold" may also assist the surgeon in finding the lower part of the ileum, a procedure which will be considered in detail under the next heading.

#### HOW TO FIND THE LOWER END OF THE ILEUM THROUGH AN ABDOMINAL WOUND

Knowing how important it may be for the operator in cases of suspected typhoid perforation, and in some cases of appendicitis, to find at once and without difficulty the lower end of the ileum just before it enters into the cæcum, I have devised a method which I have frequently used with success, at least on the cadaver. The technique of this procedure consists in carrying the forefinger over the psoas muscle and the iliac vessels, keeping the finger-tip close to the parietal peritoneum, and so entering the pelvis. The finger is then turned on its own axis and hooked upward, the peritoneum at the back part of the pelvis being followed carefully. In this procedure the finger usually goes behind the ileum, entering the cavity on the left side of the mesentery, where the finger comes against the lower end of that structure. The thumb and forefinger then close upon each other, grasping what is between them. When this is brought from among the coils of intestine, it will generally be found that it is a loop of the ileum, quite close to the ileocæcal valve. It is quite easy to do this, and to do it rapidly, in case the last part of the ileum hangs in the pelvis (Fig. 10). When, however, it lies above the ileocæcal valve, which appears to be the rule in about 50 per cent. of all cases, the manipulation just described is not always successful. A little practice on the cadaver, however, will usually enable one to trace out the lowest part of the ileum from its mesentery at the lower end of the mesenteric root.

INFLUENCE OF THE MESENTERY ON THE COURSE OF  
THE INTESTINE

It seems to me that the effect of the mesentery as a factor in determining the course of the intestine is hardly recognized as fully as it ought to be. While, as we all know, there are a number of influences which may affect the course of the intestine,—such as peristalsis, pressure from other viscera, distention by gas or other contents, etc.,—yet all these influences apparently have less effect upon the course of the intestine than has the mesentery.

*Influence of the mesentery on short segments of intestine, it curves the intestine into a single loop*

That the intestine itself, freed from its mesentery, is straight, or nearly so, is easily proved. We remove from the cadaver a piece of ileum, say a foot or so in length, and carefully take away all the mesentery from it. If we then hold it horizontally between the thumb and fingers of both hands (as shown in Fig 11), we see that it is quite straight.

If we now remove the mesentery from a corresponding piece of jejunum, and use the same test as that described above, we shall find that this segment of intestine, though not entirely straight, becomes nearly so (Fig 12).

Now that we have shown the intestine, freed from its mesentery, to be straight, or nearly so, it remains to be demonstrated that it is the mesentery which, when it is attached to the intestine, prevents the latter from assuming a straight line, and obliges it to take a curved course. If a piece of ileum, like that shown in Fig 11, is removed from the abdomen, with its mesentery still attached, it will be found quite impossible to straighten it on account of the restraining influence of the mesentery which keeps it curved (Fig 13).

The concavity of the curve in this segment of intestine is on its mesenteric border, and the convexity is on the free border. There are other curves to which the intestinal tube is subject. These will be referred to later.

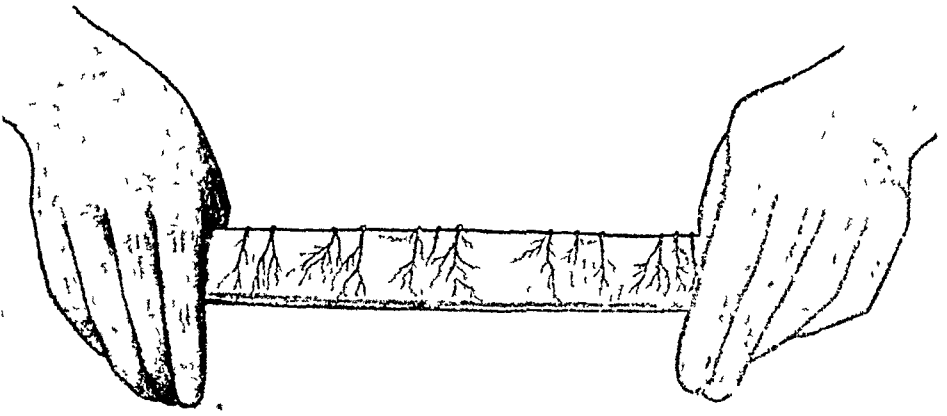


FIG 11—Showing a section of ileum from which all the mesentery has been carefully removed. The traction used is only enough to keep the upper line (the mesenteric border) of the gut straight, in other words just sufficient to overcome the natural sag of that line. The gut is seen to be perfectly straight. (Drawn directly from the specimen.)

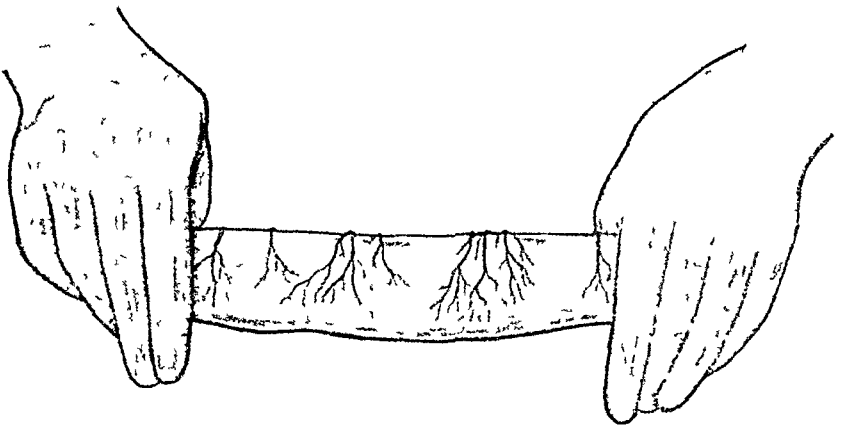


FIG 12—Segment of jejunum from the same subject which furnished the specimen shown in Fig 11. This segment of intestine though not perfectly straight is nearly so.

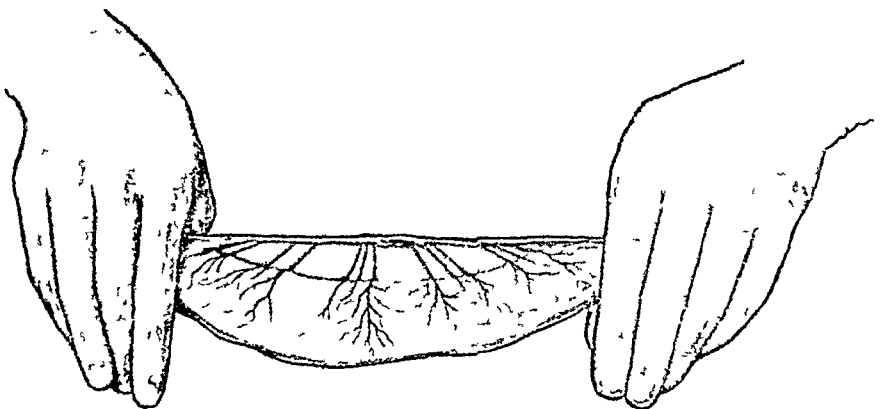
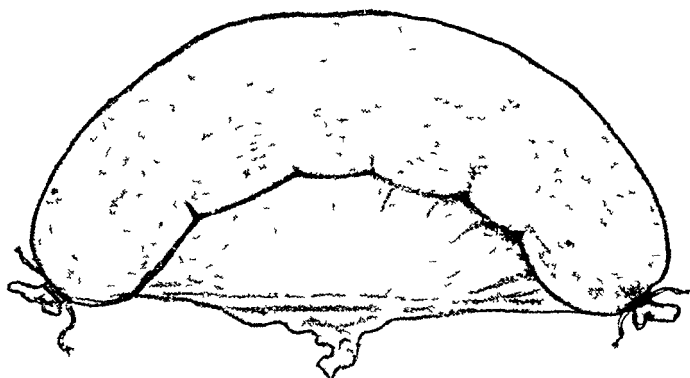
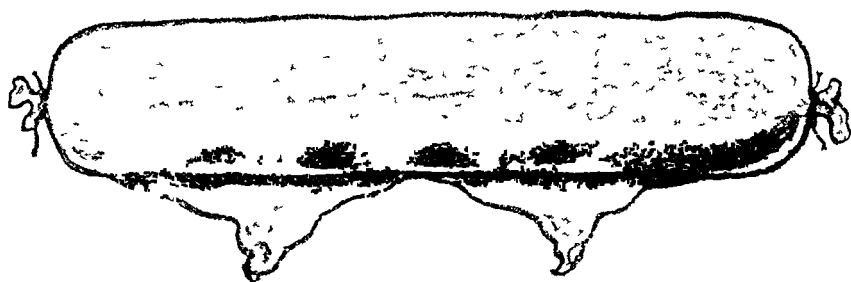


FIG 13—Representing the attempt to straighten the same piece of ileum shown in Fig 11 before its mesentery was removed. The gut cannot be straightened owing to the restraining influence of the mesentery which keeps it on a curve. The concavity of this curve is on the mesenteric border of the gut and the convexity on its free border. It is quite obvious from this figure why the length of the entire intestine is so much greater when the measurement is made along its free border than it is when made along its attached or mesenteric border.



a



b

FIG 14 (a) —Showing a short segment of intestine closed at the ends and distended with air. The V shaped piece of mesentery is still attached. The gut is strongly curved, and traction lines appear across the mesentery, suggesting a tense bowstring. (Drawn from the specimen.)

FIG 14 (b) —Representing the same segment of inflated intestine shown in FIG 14 (a). Section of the mesentery at right angles to the line of traction along its base has caused the intestine to assume a straight course. (Drawn from the specimen.)



FIG 15—Exhibiting a loop of small intestine which has just been drawn out of an abdominal wound. The transverse lines across the base of the mesentery are lines of traction, brought into prominence by the attempt to straighten the tube. The hands drawing the specimen apart at the two sides are omitted intentionally. (Drawn partly from the specimen and partly from a photograph.)

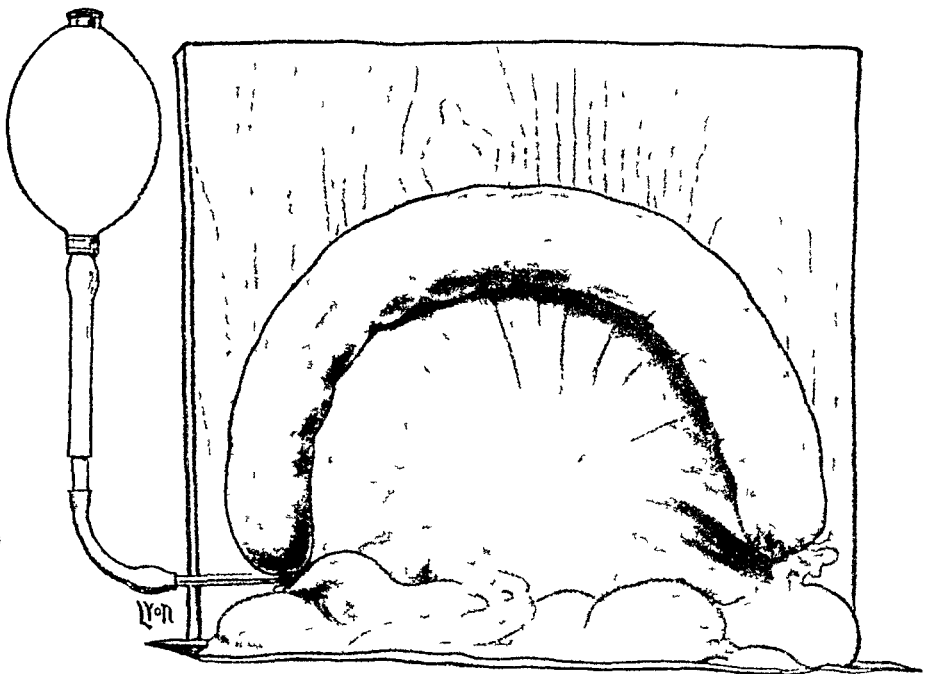


FIG 16—Showing distention with air of the same loop as is shown in Fig 15. The ruffled border of the mesentery is stretched. (Sketched from specimen and from a photograph.)

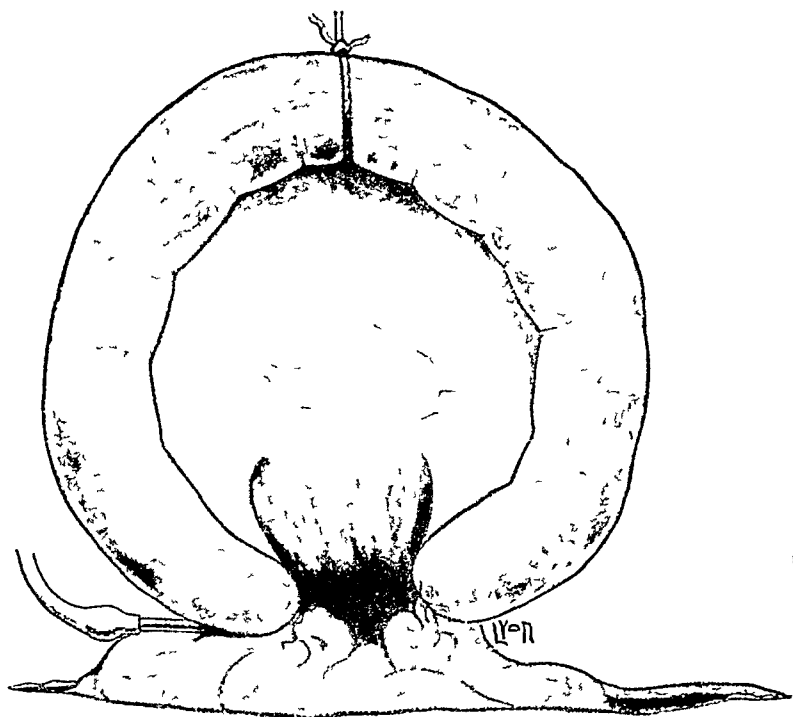


FIG 17—Showing the intestine still further inflated with air The two ends of the loop are closely approximated That part of the mesentery just inside the loop is stretched, while in the centre is a depression which is continued into a gutter running to the deeper parts of the mesentery

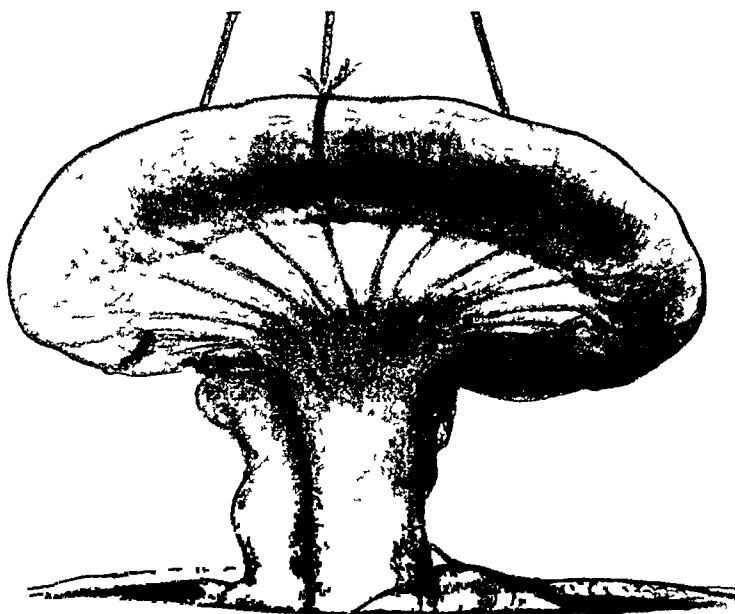


FIG 18—Exhibiting the appearance of the distended loop of bowel and its attached mesentery shown in Fig 17 as seen from the rear That part of the mesentery which is nearest the bowel is tense and flattened while the rest of the mesentery is continued downward from a point near its centre into the abdominal cavity (Drawn from the specimen and from a photograph)

The restraining effect of the mesentery is clearly seen in the following experiment. We tie up the two ends of a small segment, say six inches, of intestine, and then inflate it, the V-shaped piece of mesentery to which it corresponds remaining attached. The result will be that the distended intestine will appear curved like a bow. Traction lines, suggesting the string of the bow, will be seen on the mesentery (Fig 14, *a*).

Let us now divide the mesentery on a line at right angles to the line of traction. When this is done, the tube instantly assumes a straight course (Fig 14, *b*).

From this it seems likely that, while the mesentery corresponding to a piece of inflated intestine which is as long as six inches can curve the gut appreciably, the mesentery belonging to one-half of this length of tube cannot prevent the tube from assuming its natural direction, that is, a straight line.

The effect of the mesentery in obliging the bowel to take a curved course is also clearly seen when a somewhat longer loop is drawn from an abdominal wound, and an attempt made to straighten it. This is well shown in Fig 15. When one inflates this loop with air, its curve becomes somewhat exaggerated (Fig 16).

When this loop is still further inflated, the ends tend to come nearer together. That part of the mesentery corresponding to the ruffled border is very tense, except on that side which corresponds to the gap between the ends of the bowel, where a loose gutter-shaped depression runs down towards the base of the mesentery. From an inspection of this specimen (Fig 17), it is evident that the intestine is curved by the tense mesentery, which appears to act on the loop of gut in the same way that tense cords from one part of the gut to another would act.

On lifting up this specimen and suspending it so that the distended loop of bowel is horizontal, and, viewing it from behind, the tense part of the mesentery which lies next the bowel is also horizontal, while the narrow neck of the mesentery reaches downward into the abdominal cavity, and we see



that the whole specimen presents a certain resemblance to a mushroom (Fig 18)

Although it is not at once evident why the inflation of an intestinal loop causes the mesentery to assume this peculiar shape, yet after a little thought the reason will be clear. The horizontal and tense portion of the mesentery is the elongated "ruffled border of the mesentery," and the comparatively loose and vertical portion belongs to the deep, or proximal, part of the mesentery.

One other noteworthy thing about these inflated loops is a rotation of the bowel on its own axis, which slowly takes place while the air is being injected. The concavity of the curve of the bowel changes to one of the lateral aspects.

*Influence of the mesentery on longer segments of the intestine, the bowel is made to assume a serpentine course made up of alternating loops.* We have seen that, with the help of stout copper wire within the lumen of the intestine, we can cause the intestine to assume a course made up of alternating curves, but we have not yet determined whether such a course is a natural one on the part of the intestine. We know, of course, because of the shape of the ruffled edge of the mesentery, and also because of the fact that the intestine, at least its free border, is even longer than the intestinal edge of the mesentery, that the intestine must be thrown into coils, but we do not yet know that these coils have a tendency to alternate, first on one side of the mesentery and then on the other. A glance, however, at Fig 19, which shows this tendency in a collapsed strip of gut hanging from the two ends of its ruffled border (the rest of the mesentery having been removed), and at Fig 20, which shows this tendency still more marked when the same piece of gut is inflated, will be fair proof that such is the case.

For the next experiment a piece of bowel about two feet long was isolated by placing a ligature around each end of it. This isolated bowel was then inflated, when at once it sprang to the front and stretched its mesentery, assuming the shape of a figure of 8 (Fig 21).

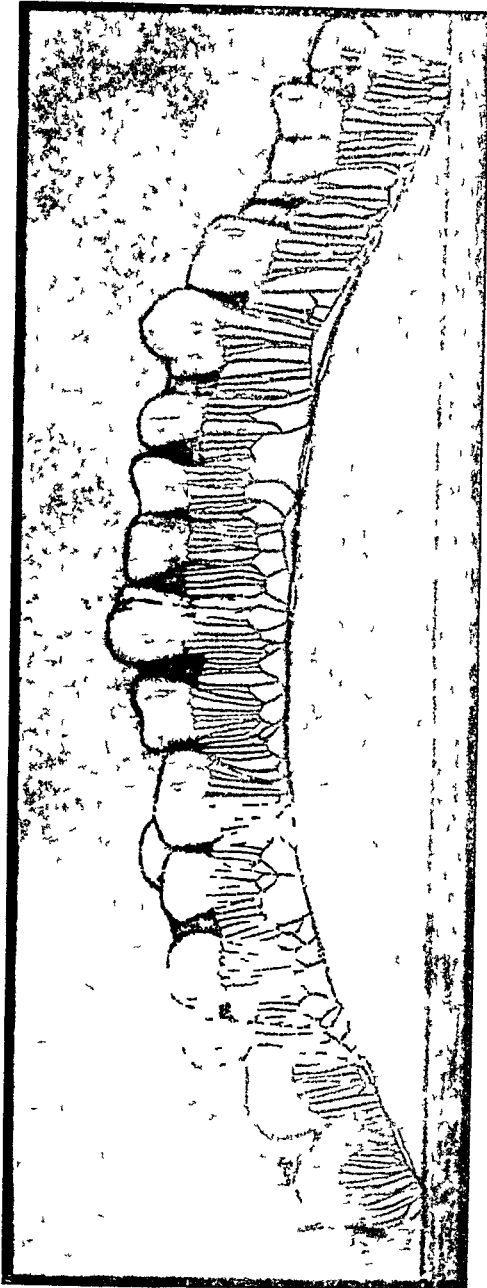


FIG. 19.—Showing a portion of the jejunum ileum from which all the mesentery has been removed except the adjacent strip, about two inches in width from the two ends of which the tube is suspended. This strip of mesentery includes nearly all, if not all, of the ruffled border. The different segments of the intestine tend of themselves to hang alternately on the two sides of the mesentery.

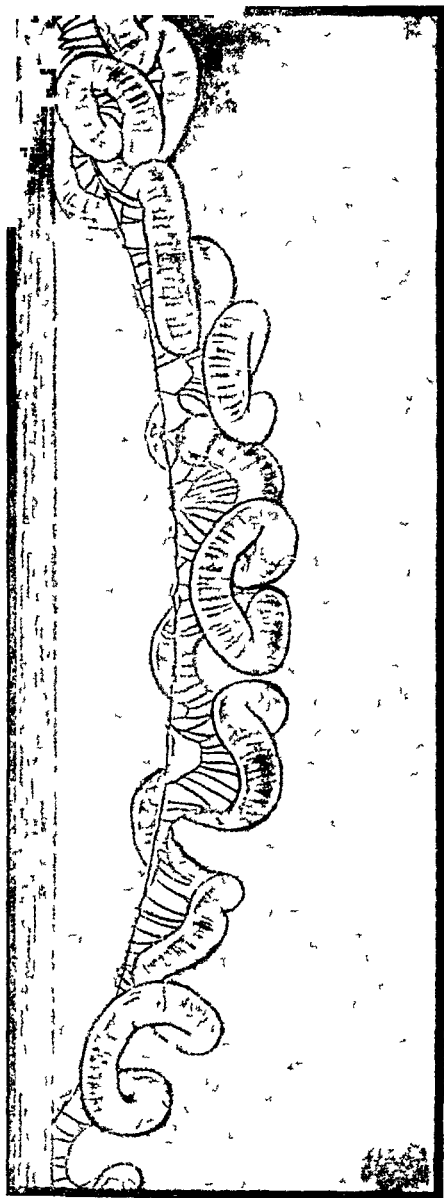


FIG. 20.—Showing the same specimen inflated. The alternation of the loops is still further emphasized. These loops spring laterally from below the cut line of the mesenteries, and tend to encircle it. Another curve, reaching from side to side and with its convexity downward, is evident along the whole length of the specimen.

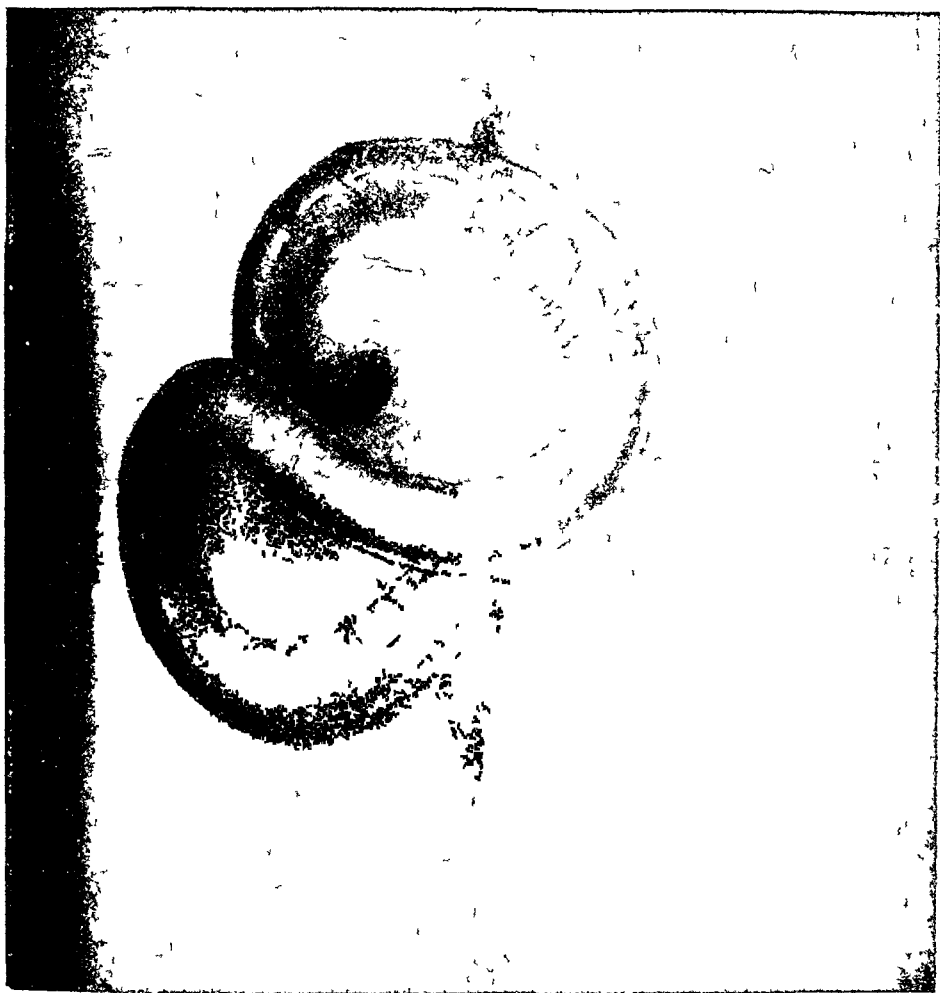


FIG 21 —Showing the figure of 8 shape assumed by a two foot piece of intestine when it is inflated *in situ*

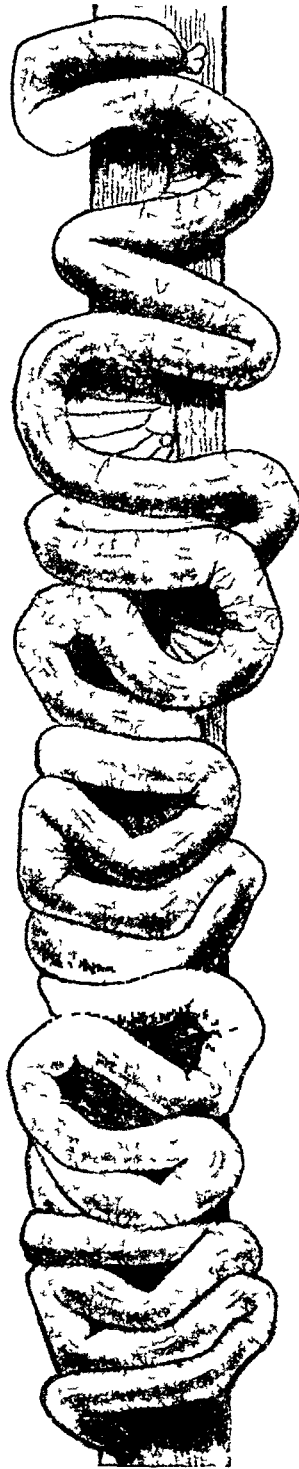


FIG. 22 —Showing the alternating curves assumed by an intestine when it is inflated, when the mesentery along the base of its ruffled edge is held rigidly in a straight line



FIG. 23.—Showing a specimen of recently removed intestine and mesentery suspended from the root of the latter, which has been nailed to a board. The whole is held in a position nearly vertical. The mass has somewhat the same relation to the mesenteric root that it would have in life if the subject was in the erect position. The alteration of the loops is evident, especially in the upper part of the specimen.



It was evident from these experiments that, while inflation of a short loop of bowel would cause such a loop to assume a single curve, inflation of a longer piece would result in figure-of-8 or sigmoid curves, and that inflation of a still longer piece would cause the bowel to assume a serpentine course, made up of a series of loops, alternating first to one side and then to the other

In the next experiment a long piece of bowel, and a strip of its adjacent mesentery about 2 to 2½ inches in depth, were used. This mesenteric strip, which roughly represented the ruffled border of the mesentery, was nailed along its proximal edge in a straight line to a board. The ends of the gut were then tied up and the tube inflated. The result was what might have been expected, for, on inflation, a fairly regular series of alternating curves formed, the mesentery assuming a corresponding shape (Fig 22)

It should, of course, be borne in mind that in the abdomen the base of the ruffled border is not straight, as represented in Fig 22, but that it is more or less serpentine in its course. This, of course, makes the arrangement of the coils of intestine as they exist within the abdomen still more complicated than it would be if this base were straight.

With the idea of simulating even more closely than in the last experiment the conditions within the abdomen, a specimen comprising the small intestine and its entire mesentery was experimented upon. The mesenteric root of the specimen was nailed in a straight line to a board, and the board held in a position nearly vertical. On examining this specimen, especially the upper part of it, we see that the natural folds of the mesentery end in corresponding folds in the gut, the alternating arrangement of the latter being evident (Fig 23)

We now inflate the bowel in this specimen, and such great irregularities appear in the distended coils that at first no definite arrangement is recognizable (Fig 24). We see, however, that there are many loops of different shapes and sizes, whose planes differ considerably in reference to one another,



and on careful inspection we recognize here and there a sigmoid curve. From what we have learned in the preceding experiments, I think we are justified in considering that each loop represents a part of the alternating arrangement of loops already referred to, the compensating loop, if not on the surface and open to view, being hidden in the intestinal mass, and also that each sigmoid curve of the intestine represents the connecting link between two such loops. The curving of the intestine during inflation, combined with the crowding of the distended coils upon one another, was very marked in this experiment. When the intestine was fully dilated, the mass of coils reached so far around the sides and back of the board on which the specimen was mounted as to nearly encircle it.

*Kinks in the intestine* Whenever my attention has been called to the existence of kinks in any part of the intestinal tube, I have noticed that these kinks are almost invariably *on the lateral aspect of the gut*, that they are seldom on the mesenteric border, and only in the rarest instances on the free border. There are several examples to be seen in Fig 24. Kinks are simply exaggerated instances of sharp curves, and are caused, at least when the gut is distended, principally by the restraining effect of the mesentery, which obliges the intestine at these points to double sharply on itself. The pressure exerted by the other coils in the neighborhood probably assists to some extent in the formation of these kinks.

#### COURSE OF THE INTESTINE AS AFFECTED BY CONDITIONS WITHIN THE ABDOMEN

When the intestines are within the abdominal cavity, the conditions are so different from those we have been considering that it is not surprising to find the regularity in the disposition of coils considerably interfered with. New factors, such as pressure from other viscera, or from one coil on another, or from unequal weight because of distention by gas or fluid intestinal contents, or from peristalsis, or from the changing position of the body, add very disturbing elements to the regu-

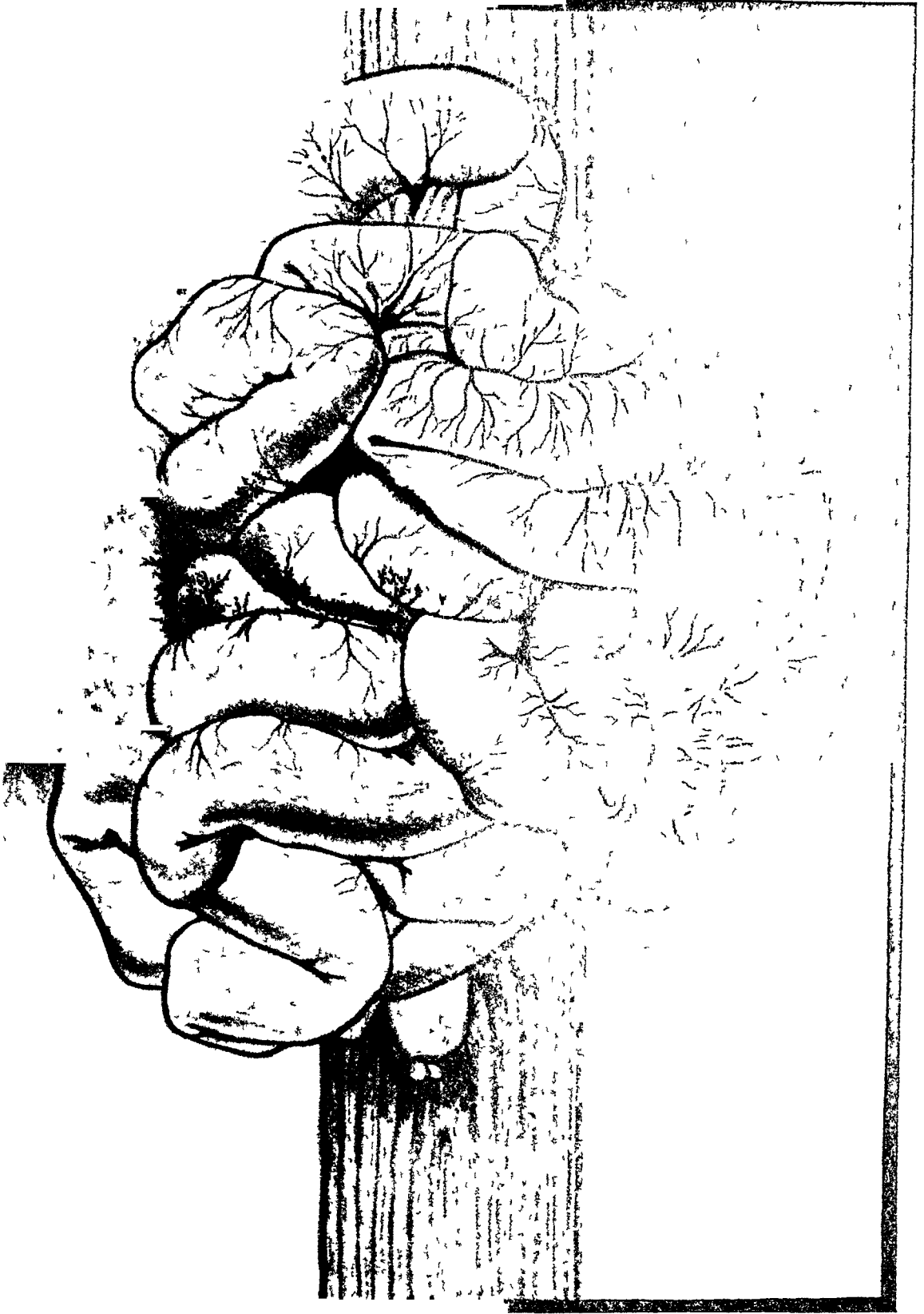


FIG 24 —Showing the effect of inflation on the intestine seen in FIG 23. The specimen is still held to the board by the root of the mesentery. The various loops of intestine, some of which appear in well rounded curves or in kinks, while others take a sigmoid course, presumably form parts of the alternating arrangement of loops to which reference is made in the text.

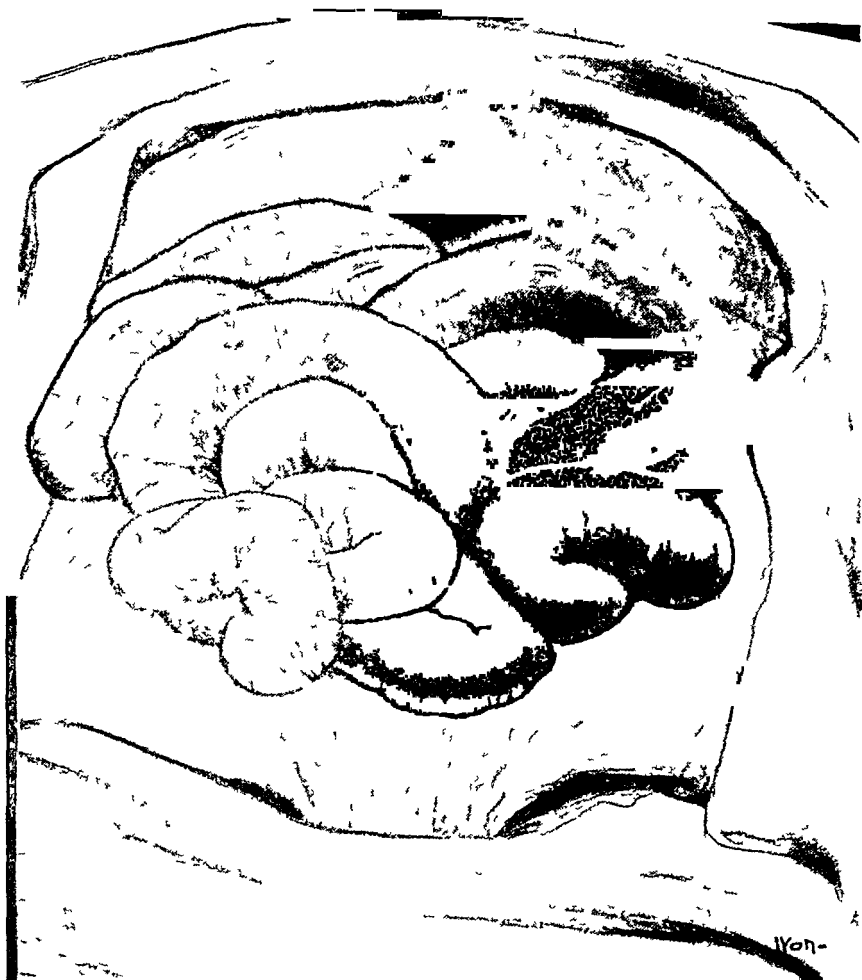


FIG. 25—Exhibiting the wide open abdomen in which the coils of small intestine, having been moderately distended with air have sprung to the front. Large loops of different curves and a few kinks are seen. Presumably the compensating loops are mostly buried in the mass of intestine. One sigmoid curve is evident in the left lower corner of the drawing. (Drawn from the subject.)

larity of the alternating curves Some of the curves may be longer and some shorter than most of those which we have thus far been considering, and their planes may be greatly altered in reference to one another, one curve being in the front of the abdomen, and the next in the middle or back of it, but, by careful examination, evidence of some such alternating arrangement as we have spoken of can generally be made out, *if we look far enough*, for I hold it to be impossible, on account of the arrangement of the ruffled border of the mesentery, to which is attached an intestine longer than itself, that a segment of intestine can proceed for any appreciable distance on one side of the mesentery without crossing to the other side to form a compensating curve In Fig 25 the entire small intestine is shown inflated *in situ* Most of the loops are large ones. There are a few kinks The compensating loops are presumably beneath the other coils One sigmoid curve appears

#### CONCERNING DISTENTION OF THE INTESTINES, EXPERIMENTS IN THE INTRODUCTION AND REMOVAL OF AIR AND WATER

I have often noticed that when in operations an enterostomy is done to relieve a gut distended with gas and liquid contents, usually little gas or other contents escapes at the time of operation, and that, therefore, the abdominal distention is not reduced to any great degree I have therefore opened a number of gas-distended coils on the cadaver, to find that in every case the collapse of the gut which followed the escape of the gas was a purely local one, only a coil or two emptying its contents, while the rest of the intestine remained as much distended as before It was obvious, therefore, that there was some obstruction to the escape of the gas from the other coils of intestine, and I came to the conclusion that the small intestine consisted presumably of various segments, not always opening freely into one another, which segments acted as separate reservoirs for gas or other contents, and that the

collapse by emptying of one of them did not necessarily mean the emptying of the others, at least, not their immediate emptying. These remarks refer, of course, to the dead intestine, or to the living one which is completely paralyzed.

In order to study this matter a little farther, I conducted a number of experiments by inflating the gut on cadavers. All these experiments were performed with the abdomen fully laid open. First, I inflated the whole tube by the use of a hand bulb, forcing air through a cannula into the intestine. The effect was what might have been expected, for the loop nearest the cannula would slowly become distended, and, as it did so, it would spring up from its bed, at the same time putting its mesentery on the stretch. At this point it was noticed that it was harder to inject air into the gut than had been the case at first, in other words, one seemed to be working against a slight obstacle. This obstacle would suddenly give way, and the inflation process would go on smoothly for a time until another obstacle was met, which in its turn would also give way, and so on, one chamber after another being opened up until the entire gut was fully inflated, when usually air could be forced from one end to the other. During all this, with each new reservoir opened up, the loop into which the air was entering would spring to the front and stretch its mesentery. When the whole tube was fully inflated, an incision into any coil would be followed by a gradual subsidence of apparently all the coils. This would take place up to a certain point, when the general collapse would be arrested, and the complete collapse of the coils nearest the opening follow, the other coils still remaining somewhat distended. Obviously, the pressure remaining within the distended coils was not sufficient to force out all the air which had been injected. Gentle pressure on the distended coils had the effect of forcing out more air, and massage was still more effective, but it was next to impossible to remove all the air without actually "stripping" the intestinal tube throughout its whole extent.

Some injections were tried with water and some with

water and air, but they demonstrated little beyond what one would expect, that is, that the water sank to the most dependent parts of coils, the air remaining in the uppermost parts. It was interesting, however, to note that when a distended loop on the front of the abdomen (the subject lying on his back at the time) was punctured, air escaped, but no water, and that on opening one of the most dependent loops water escaped, but usually little air. This water in the dependent loops evidently acted as a most efficient trap, like a plumber's trap, separating the different segments of the intestine, and, inasmuch as no single coil can continue along the anterior abdominal wall for any distance without taking a course near the back, it follows that wherever there is fluid enough in the intestines there must be traps which shut off the different compartments of the small intestine from one another. It is quite possible, in intestines filled, as in peritonitis, with gas and semiliquid contents, that the gas is in the loops nearest the abdominal wall, the fluid being posterior in the dependent loops. If this is the condition of things, it is evident that opening the gut, or, in other words, doing an ordinary enterostomy, will not be followed by an immediate discharge of all the contents or a collapse of the bowel, but that it will be necessary to wait for a certain amount of peristalsis to drive the intestinal contents downward. In addition to the obstacles presented by these traps in the most dependent loops, there are, of course, other obstacles, for semisolid contents may act as such, or obstructive kinks may be present in the intestine. Apparently also the weight of the intestinal mass may press the sides of the gut so firmly together that even the pressure within the adjacent distended gut is not sufficient to open up the tube and allow the gas to pass on.

A few experiments were made with the idea of determining whether it was possible, by suction through a tube tied into the gut, to empty an appreciable length of the intestine. The results were very unsatisfactory, as the experiments showed that very little fluid or air could be withdrawn from the

intestine in this way Equally unsatisfactory was the result of an attempt to irrigate from one end of the intestine to the other This was tried only once, the abdominal contents being *in situ*, and the median wound in the abdominal wall being united over them The greatest care was taken to inject the water slowly and gently The result of the experiment was, as might have been expected, to show that such irrigation would be quite impossible on the living subject, for in the experiment the intestine ruptured and the fluid escaped into the peritoneum \*

#### THE PASSING OF INSTRUMENTS INTO AN ENTEROSTOMY OPENING

While the passage of a tube into an enterostomy opening in the gut may allow the escape of a considerable quantity of intestinal contents, beyond that which has escaped from the hole itself before the tube was inserted, and while this quantity may be somewhat increased by gentle massage of the abdomen or by flushing, it is hardly possible, on account of the tortuous course of the tube, to pass any instrument, hard or soft, straight or curved, for any appreciable distance either upward or downward, without the probability of very soon engaging a sharp curve or kink in the gut Before, however, the tip of an instrument reaches a kink, or even a sharp curve, it is very likely to engage the wall of the gut, usually its free border (Fig 26) This I have repeatedly

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\* During these experiments, the attempt was made on two or three occasions, when the gut was fully inflated, to rupture it by what has been called "blunt violence" It was thought possible that distended intestines might rupture under a blow, just as an inflated paper bag ruptures under it, and that, if so, this fact might explain how the bowel may be ruptured, without apparent injury to the abdominal wall, by the application of blunt violence Though the results of these experiments were entirely negative,—for in no case did a rupture take place,—yet the experiments were too few to justify any definite statement as to the possibility of a rupture occurring in this way It is quite possible, also, that the cadaver is not suitable for experiments of this kind

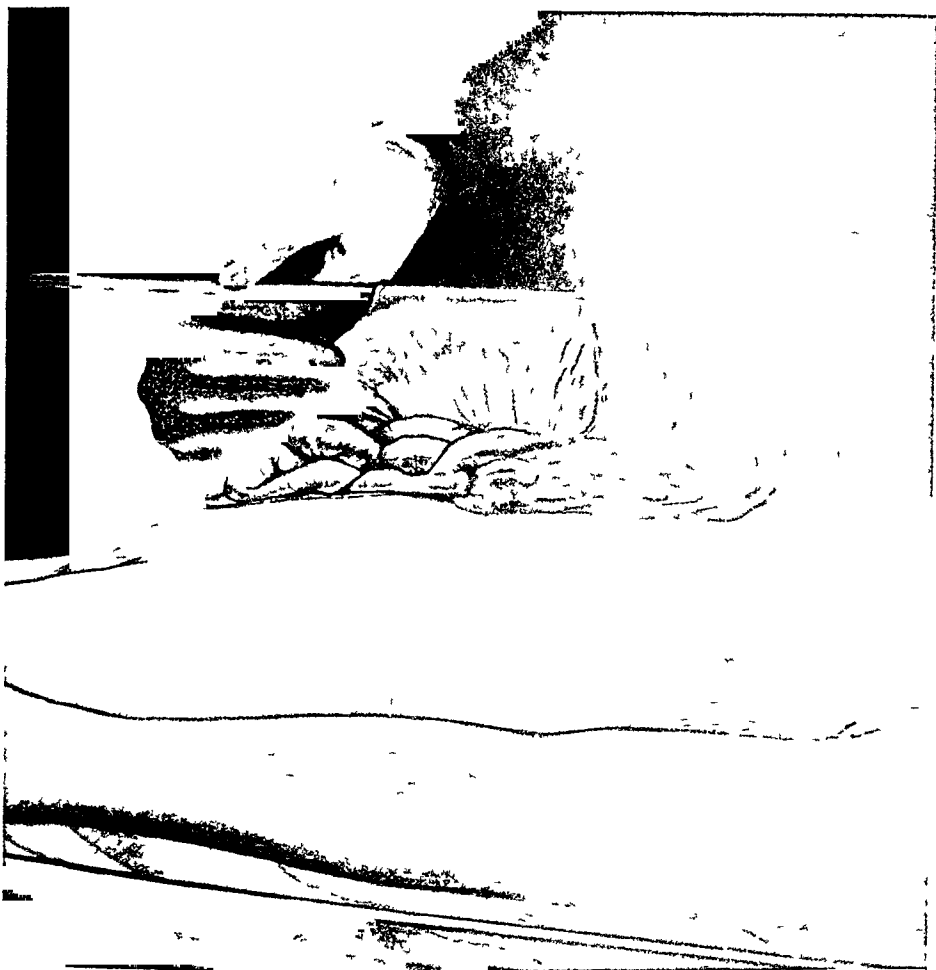


FIG 26—Showing how soon a straight instrument passed into the gut may engage its free border





proved on the cadaver, with different kinds of tubes, both hard and soft, when the gut was collapsed as well as when it was inflated

A number of experiments were made to determine what length of intestine could be "gathered up" on a tube when the instrument was passed through an abdominal wound of the ordinary length, and also through an opening into the gut such as is made in most enterostomies. The tube best suited for this purpose was found to be a glass one with a curved extremity, the opening being on the concavity of the curve. The circumference of the tube was about half again as large as an ordinary lead-pencil. The largest size Coudé catheter answered the purpose nearly as well. The results, however, were not encouraging, for, while it was found that such a tube could be made to penetrate much farther in either direction than any of the soft tubes, it could not take up much more than three or four feet of the intestine, for the reason that the intestine could not be pulled farther out of the abdomen without undue traction on the coils within. Before leaving this subject, however, it should be said that if the wound in the abdominal wall can be made long enough, and if the tube itself is also of sufficient length, the greater part of the gut may be gathered up on the tube.

#### CONCERNING THE DETERMINATION OF THE REAL DIRECTION OF THE BOWEL IN A LOOP OF INTESTINE

In connection with the work on intestinal localization already referred to, another study was made, also on cadavers, for the purpose of determining through an abdominal wound which was the proximal end of an intestinal loop, and which the distal. The method by which this determination was made was by following down the mesentery on one side of the gut as far as the mesenteric root. On cadavers the tests resulted in a large proportion of successes, and on the living subject, where I have been able to apply it in a certain number of cases, I have made, as far as I know, no errors. In

case twists of the mesentery are felt or seen, one should be careful to rotate the loop in such a manner as to untwist these and cause the intestine to run in the same direction as the base of the mesentery, when the mesentery, now parallel with its line of attachment, can be followed down to its base by the finger, and, in case the coils in the neighborhood are strongly retracted, by the eye. Failures, indeed, are possible, as, *e g*, when the wound is so far away from the mesenteric root that the latter cannot be reached with the finger,\* or where complicated twists or extensive pathological processes prevent a proper manipulation or view of the root of the mesentery. Since first writing on this subject, I have been impressed with the obvious advantage of examining the mesentery on both sides instead of only on one side, the findings on the one side being verified or disproved by those on the other. In fact, on several occasions, I have been able to grasp the mesenteric root of the cadaver between the thumb and fingers of one hand, thus enabling me to determine the direction of the bowel with certainty. It is quite possible that this method may be of use on the living subject when the wound is large enough, and when a knowledge of the real direction of the gut will be of sufficient value to justify the manipulation†. The method of procedure is as follows.

The loop of intestine is gently lifted from the abdominal cavity, and the assistant grasps its two extremities and holds

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\* Though this method for determining the direction of the tube in any loop presenting was, I at first thought, original with me, I later found, as I stated in my article, reference to the method in Woolsey's "Surgical Anatomy" (1902), and, after the publication of my paper, I learned that it had been also spoken of in Stimson's "Operative Surgery" (1895), and in a short article in the London Lancet (December 22, 1883), by Mr Rand. This last is the earliest reference to the subject which I have been able to find.

† Since writing the above, I have been able in an operation on the living subject to correctly determine the direction of a loop of bowel by this method.

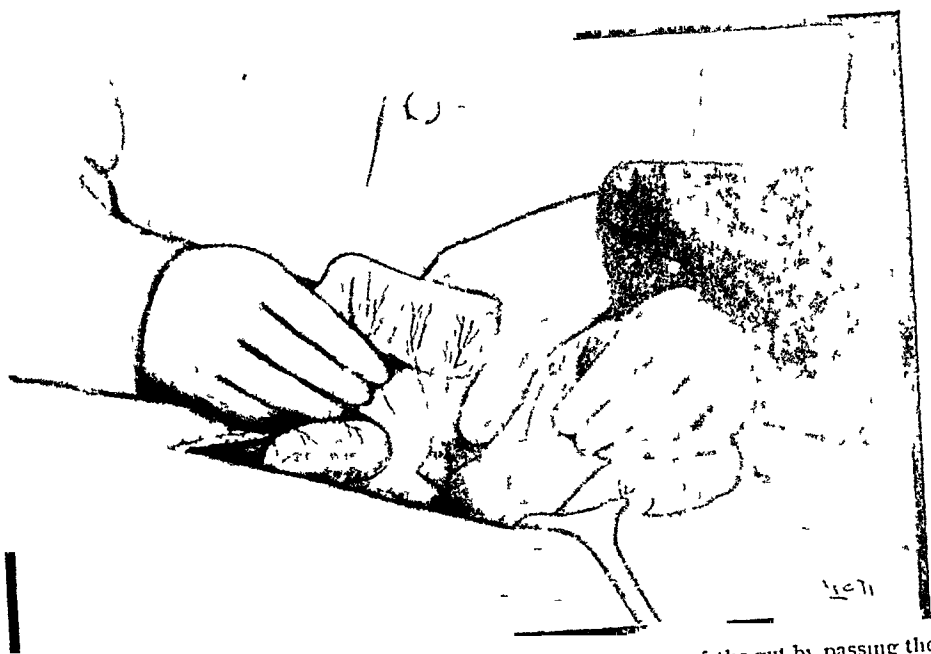


FIG 27—Showing the method of determining the real direction of the gut by passing the thumb down on one side of the mesentery and the fore and middle fingers down on the other in the direction of the mesenteric root



it suspended horizontally The surgeon, putting his thumb on one side of the mesentery and his first two fingers on the other, insinuates them slowly down towards the root of the mesentery, the slack of the mesentery being taken up by his other hand and by the hands of his assistant (Fig 27)

By this method, which requires a little practice, the examiner can instantly determine, and this usually before he reaches the mesenteric root, whether or not there is a twist in the mesentery If there is a twist, it should be untwisted by rotating the loop of bowel, and the mesentery again examined When there is no twist of the mesentery, and the loop lies parallel with the mesenteric root, the upper end is the proximal end of the loop and the lower end the distal \*

### CONCLUSIONS

Such is the nature of this paper that it does not admit of a satisfactory summary of all the points which have been spoken of in it As, however, there are certain features which I particularly wish to emphasize, I put these in the form of conclusions I have attempted to show

1 That the relative shape of the mesentery and intestine *in situ* can be best understood by arranging the intestine in a series of alternating curves upon a wire, thus putting all parts of the intestine and mesentery gently on the stretch

2 That the mesentery may be roughly divided into two portions (1) a proximal or flat portion, which comprises

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\* A short time ago it occurred to me that, on the living subject, it might be possible to determine the direction of the bowel by the direction of the wave of impulse in the main branches of the superior mesenteric artery near the mesenteric root, it being, however, first made certain that there is no twist in the mesentery between the artery and the gut This I have tried with success a few times on the cadaver, the impulse in the arteries being simulated by the rhythmical inflation of the vessels with air I mention this method, however, only incidentally Whether it can ever be made of practical value, I do not know The only advantage it has over the methods already spoken of is that, in carrying out the test, it is not usually necessary to go as far as the mesenteric root, since the main arterial branches are often at some little distance from it

about two-thirds or three-fourths of the mesentery, and (2) a distal or ruffled portion, the "ruffled border," which comprises the remaining one-third or one-fourth

3 That the main sheets of the mesentery alternate from above downward, going first to the left, then to the right, and finally proceeding to the iliac regions and pelvis \*

4 That the fold of mesentery which descends into the pelvis can usually be palpated from a wound in the lower abdomen, and that it forms a valuable guide for the finger in the attempt to reach the left abdominal fossa (I would make the suggestion that this fold be known as "the pelvic fold of the mesentery")

5 That the part of the ileum which is about to enter the cæcum can usually be picked up from a right iliac wound by the forefinger, which, after passing into the pelvis, is curved upward around "the pelvic fold of the mesentery"

6 That while the intestine freed from its mesentery is straight, or nearly so, the mesentery when attached to it obliges it to follow a curved and tortuous course

7 That, when the gut is attached to the mesentery, the free border of the gut is several feet longer than its mesenteric border, and that the free border may therefore properly be called "the long side," and the mesenteric border "the short side," of the intestine

8 That the influence of the mesentery is such that the intestine is thrown into a series of alternating loops of varying shapes, sizes, and planes

9 That kinks in the intestine are usually confined to the lateral aspect of the gut

10 That a distended and paralyzed intestine, filled with gas or semiliquid contents, does not at once empty itself through an enterostomy wound That the cause of this is obstruction, not only from sharp curves and kinks, but also from outside pressure on the tube, and still further because

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\* This roughly agrees with Mall's findings as to the arrangement of the different coils of intestine

the fluid portions are in the dependent loops, where they act as traps to obstruct the passage of gases along the tube

11 That, unless the intestine be "gathered up" on the tube, it is impossible to pass any instrument, hard or soft, straight or curved, into the gut without the probability of soon engaging the wall of the intestine, usually in its free border

And, finally (12), that, when the size of the wound and its situation will permit, the surest method, at least on the cadaver, of determining which is the proximal and which the distal end of a loop of intestine is by palpation of the mesenteric root between the thumb and fingers of one hand



# A STUDY OF INFECTION OF THE KNEE-JOINT BASED UPON AN ANALYSIS OF 310 CASES

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INFECTION in any wound presumed to be clean is a source of chagrin. The discomfort is somewhat modified by the possibilities in the individual case, but infection in certain regions is always looked upon with veritable horror. One of these regions is the knee-joint. Every surgeon has a clear conception of this calamity, and so pronounced is the impression universally, that there can be no doubt that many joints which might be opened to advantage are left untouched. We have investigated the subject for the purpose of determining, if possible, which cases are responsible for this general attitude, and to ascertain whether in the light of modern surgical technique this aversion is justified in all cases.

Fortunately and unfortunately, one's experience with infection of the knee is relatively small. Fortunately for evident reasons, unfortunately because much of value cannot be known as a matter of personal experience, but must be accepted as applying to scattered cases observed by different men.

During the last eighteen months the writer has endeavored to collect such data as would seem to bear upon this subject, and has examined the records of all cases available to him.

I am indebted to many surgeons in New York for allowing me to use their hospital cases in connection with my personal operations upon the knee, and, inasmuch as the cases were taken "as they came" in the records during the last ten years, it would seem reasonable to assume that the data obtained represent more nearly the actual state of affairs than would a similar collection of cases from literature.

Tuberculous, gonorrhœal knees and those occurring in

connection with osteomyelitis of the tibia and femur are not considered, only such as were operated for what is commonly termed "surgical infection" It may perhaps with justice be claimed that there is no reason for excluding the cases secondary to osteomyelitis, but the combination of osteomyelitis of the bones and knee-joint infection is such a vicious picture that the final results influence any conclusions all out of proportion The condition is so disastrous as to be better treated by itself

Comparatively few cases were investigated from a bacteriological stand-point,—evidently because the information derived would not have altered the course of treatment in the individual case There is still much of value to be learned from more accurate knowledge of the bacteriology of knees which present all the cardinal signs and symptoms of infection

Infection occurred in five groups of cases

- a* Clean knees operated
- b* Penetrating wounds of the knee-joint
- c* Primary in the knee without evident port of entrance
- d* In the course of evident infections elsewhere
- e* Following some trauma (non-penetrating)

Before entering upon a discussion of such cases as were operated because of the infection, let us examine the cases coming under any one of these five headings which did not seem to demand operation, and define our position with reference to the term infection By infection we mean the entrance of bacteria into the joint, which event is followed by the cardinal signs and symptoms of such infection,—redness, pain, heat, loss of function, temperature, rise of pulse, etc It is unnecessary to state that these cardinal signs and symptoms may be present to any degree The presence or absence of pus is not considered Pus is a vague term to be classified with such indefinite expressions as "fungus," for instance There has grown up the idea that whenever this cloudy fluid which we call pus is found, the containing cavity should be opened as extensively as possible This is a blind method of procedure, which cannot be made to apply universally however appropriate in the vast majority of cases Everybody knows

that certain pus cavities will heal after aspiration, and we prefer this method when conditions allow because of the danger of secondary infection. The relation between the character of the infected fluid in a knee-joint and the patient's power of resistance as indicated by the cardinal signs and symptoms of infection is our guide for operating. A knee-joint may contain creamy pus with very few signs and symptoms. This joint would better be aspirated and treated, as certain inguinal and tuberculous abscesses, rather than open freely and expose to all sorts of contamination. Not pus, but the character of the contained infected fluid is our guide for free openings.

It is common occurrence to obtain a negative bacteriological report from abscess cavities, yet nobody questions the infectious origin of the trouble. This applies also to the knee-joint. That the knee-joint exercises a certain amount of germicidal power as we should expect can be demonstrated in the following manner. When operating upon a knee with an excess of synovial fluid, first aspirate into a clean cover dish, on opening the joint, uncover this dish and one containing gelatin or agar. Cover them at the end of the operation and place in an incubator. Both will be found to contain colonies. The fluid in the joint is again aspirated on the day the cultures are investigated, examined immediately and placed in a cover dish. Both examinations will prove negative in cases we consider clean. There is no reason to suppose the air immediately over the field of operation was any cleaner than that over the two dishes. If more knees were examined in this way, we should be in a better position to state what the bacteriological condition of many knees were which show postoperative signs and symptoms not to be distinguished from those produced by infection.

Again, we have the knee presenting cardinal signs and symptoms of infection, yet on aspiration the joint fluid is sterile. These are supposed to be due to toxins secondary to some infection elsewhere in the body which may or may not be apparent. How many of these knees are really due to this

ascribed cause will only be known when we have more information regarding the milder cases of bacterial infection which recover without open operation

Every surgeon has regarded with anxiety the signs and symptoms arising after an operation upon the knee and in cases of penetrating injury to the joint. The cardinal signs of inflammation are all there, but not sufficiently marked to demand reopening the joint. The symptoms gradually subside, the knee recovers. There can be absolutely no question that certain of these joints are mildly infected.

Another group, the last, which may present these cardinal signs are the non-penetrating traumatic knees. Almost every severe injury to the knee presents these signs to some degree, yet we do not worry; the joint is not open, and we know that infection otherwise than through a wound is rare. Still, this can happen, as we shall see later, and in the absence of bacterial proof we cannot claim that even some of these knees are not infected.

There is one point, however, which attracts attention. Non-penetrating injuries to the joint rarely show signs and symptoms for any length of time, whereas in penetrating wounds, whether operative or traumatic the symptoms continue for several days up to weeks. It does not seem reasonable to assume that the penetrating nature of the wound should be made responsible for this difference in the clinical picture. We prefer to consider that many of the penetrating cases are infected.

A late examination in any one of these five classes does not enable us to state what was the primary cause of the function disability. The same condition may be secondary to trauma, bacterial infection, or irritation from toxins. Our only guide would be a bacteriological investigation at the time of the primary difficulty, and, although made in scattered cases, the number we have is not sufficient to warrant any more definite statement than the above.

Joints belonging to the rheumatic group have not been considered.

The fact that there are cases belonging to each of the above five groups which do become so bad as to demand operation, and the fact that bacteriological proof does exist in certain of these cases, is evidence sufficient that all of these joints do at times become severely infected. It is not reasonable to assume that when infection does occur it is always severe. Mild cases must also exist, the above mentioned unknown quantity, *ie*, the relation between power of resistance and character of infection, alone determining the nature of the clinical picture.

The situation is quite different when we consider the cases which have been operated because of infection. Here the data at hand, although not complete, are sufficiently accurate for clinical purposes to allow of deductions regarding the frequency of infection of the knee and the final outcome of such cases. Of 237 clean knees operated, 11 became infected and were subsequently reopened. This means that approximately one out of every 21 to 22 operations upon clean knees becomes sufficiently infected to demand opening and draining the joint, *ie*, 4.6 per cent. If we investigate to determine what the immediate outcome of such infection is we find that one case came to amputation, *ie*, 9 per cent of the infected cases, and that the stay in the hospital was from one to six months, the average being three months and ten days. This does not mean that the patients were all well on discharge. Many had sinuses. It would not be of any value to say what percentage, because of the uncertainty of the data obtained on this point. Many were discharged with varying degrees of functional disability, from slight limitation of motion to complete ankylosis, with some subluxation in a few cases.

On examining these septic cases somewhat more closely, we find that in 8 of the 11 the primary reason for interfering was some recent trauma, and that in only 3 was the operative indication some other pathological condition. This means that of clean operative cases which become infected, about 73 per cent are traumatic cases primarily and only 27 per cent of pathological origin. The total number of traumatic cases

operated before the fifth day was 66, seven of which became infected, *i e*, about 11 per cent

The total number of non-traumatic cases and traumatic cases operated after the fifth day was 141 with four infections, *i e*, one out of every 35, or about 2.9 per cent

The total number of non-traumatic pathological cases (loose cartilage, foreign bodies, chronic synovitis, etc.) was 70, with three infections, *i e*, one out of 23, or about 4 per cent

In 28 cases the time data could not be obtained

The fracture of the patella group is largest and perhaps of greatest interest. Of 150 simple fractures of the patella operated, seven became infected and demanded subsequent operation, *i e*, one out of every 21 to 22, or about 4.66 per cent. The other groups are represented by so few cases comparatively, that no statistical representation of value could be brought forward. Of the septic patellæ, one was operated four hours after injury, four on the second day, one on the third day, and one after some months. In 128 of the 150 cases of operated fractures of the patella, the time elapsed between the injury and the operation could be determined. In 71 of these it was five days or more, in the remaining 57 it was under five days. Of the cases operated on after the fifth day one became sufficiently infected to demand operation, of the 57 operated on before the fifth day, six became infected. Provided the time elapsed between injury and operation in the 22 cases where the data are insufficient is in the same ratio as in the 128 cases where the time is given, the percentage of simple fractured patella operated after the fifth day which become infected, is about 12 per cent, whereas of the cases operated before the fifth day, 8.9 per cent become sufficiently infected to demand reopening the joint. This would seem to indicate that in this region operating in bruised, lacerated tissue before active repair processes are well established is about eight times more liable to be followed by infection than when operating after a delay of five days, which corresponds in kind with experience in traumatic surgery elsewhere in the body.

The next group consists of the infections in penetrating traumatic wounds. The data obtained here are such as to make us always look upon an accident of this sort with anxiety.

Of 52 penetrating traumatic wounds, 30 became sufficiently infected to demand secondary operation. These were lacerated wounds 19, punctured wounds, 8, 1 compound wound of joint with small piece of condyle broken off, infected, 3 gunshot wounds, with two infections. This means that three out of five, or about 60 per cent, of all penetrating wounds of the knee-joint become severely infected. The numbers in the individual groups are so small as to preclude deductions, but if the lacerated and punctured wounds be considered together, it is found that 20 out of 39 were infected, *i e*, about 50 per cent, and if the compound fractures of the patella be examined separately, it will be seen that seven out of nine became infected, *i e*, about 78 per cent.

The immediate outcome of these penetrating infected wounds is as follows. Of 30 cases, four died with or without previous amputation, two legs were amputated, and two knees resected. Of the remaining 22, two were removed from the hospital against advice, while 20 were discharged sooner or later with a varying amount of disability. Four of these had complete ankylosis on leaving the hospital. The stay in the hospital varied from five days to six months and two weeks, the average being two months and three weeks. This is somewhat less than the average for operations upon clean knees which become infected, due possibly to the fact that three of the fatal cases were in the ward less than one week. All of which means that one out of every thirteen penetrating traumatic injuries to the knee-joint died, *i e*, a death-rate of 7 to 8 per cent, and one of every seven to eight of the infected cases dies, *i e*, a death-rate of 13.3 per cent. One out of every 26 cases of penetrating traumatic wound to this joint comes to amputation, *i e*, 3 to 4 per cent, and 1 in 15 of the infected cases comes to amputation, *i e*, 6 to 7 per cent.

We next consider the cases which become infected suffi-

ciently to demand operation after some known injury to the joint. These cases were not operated for the trauma. Of these we have been able to collect six. The injuries were: One horse-kick, two blows, two falls, one run over and knee twisted. In none of these was the joint opened. The signs of infection became sufficient to demand operation on the fourth, fifth, seventh, tenth, and twenty-first day. One case died, one came to amputation. The other four were discharged with a varying amount of disability. These cases stayed in the house, with the exception of one case leaving against advice, from five days to five months and two weeks, the average being two months. The infection must have occurred much in the same way as in acute osteomyelitis after injury.

The next group of cases includes those infected knees where no history of trauma or evident focus of infection elsewhere could be found. There are eight cases. One died after amputation, the rest were discharged with varying degrees of functional disability. It is a curious fact that each and every history in this group, taken by different men at different times, points out that the onset was sudden, sometimes with chill. The time elapse between onset and operation varied from ten days to six weeks, the average being three weeks and five days. There were three males and five females. A bacteriological examination made in six cases showed "cocci" and denies gonococci. We know that other bacteria besides the ordinary cocci can infect joints, especially the pneumococcus, but, inasmuch as all of these patients were between eighteen and forty years,—the gonorrhœal age, as it were,—five being twenty-five or under, and considering the fact that five were females, not apt to be questioned or examined too closely, a quite unusual preponderance compared with the sex ratio in the other groups, it would seem to me that some of these bacteria might possibly have been gonococci.

The last small group of cases represents those infected knees occurring in the course of some evident infection elsewhere or immediately after such infection. The conditions in connection with which these joints appeared are as follows.



Multiple boils, one case, severe bronchitis, one case, excision of gumma of thigh, one case, cholecystitis, one case, septic uterus, one case, inguinal adenitis following septic focus on foot, two cases, seven cases in all. One case died, the rest discharged. The knee symptoms appeared from the second to the twenty-third day after the onset of the first septic process. Unfortunately, there is no bacterial proof that the two processes were caused by the same bacterium. In three cases "cocci" were found in the joint, but in the remaining four there is nothing to prove that the conditions might not belong to the group of cases supposed to be caused by the irritation of toxins or by an independent infection.

If all of these septic cases be considered together, we have sixty-two infections sufficient to demand operation. Of these seven died, *i e*, about one in nine, or about 11 per cent, four came to amputation, *i e* one in fifteen, or about 6.6 per cent, two were resected, *i e*, 3.3 per cent, and 49 recovered, *i e*, about 76 per cent, with functional disability varying from slight limitation of motion to complete ankylosis. The average stay in the hospital was between two and three months (ten and one-half weeks).

In searching for data which might aid us to treat these severe infections more successfully, we find little that is to guide us. There are numerous knees evidently infected which are never opened or reopened, still, they recover with varying subsequent disability. As already mentioned, the bacteriological information which would enable us to interpret many of the conditions is absent except in individual cases. At the present time, a knee-joint is reopened only when the combination of signs and symptoms is such as render it beyond question that we have to deal with an extreme condition. The final outcome is well indicated by the above remarks. Had we more definite information regarding the early stages of these severe conditions, and were we able to distinguish from joints, which, although presenting similar signs and symptoms, were not apt to run so vicious a course, we would be in a posi-

tion to attack the severe infections earlier and perhaps improve the outlook

If a joint is to be opened and drained at all, the first operation should be radical. If open operation is necessary, it is necessary to be extreme. This is plainly shown by the fact that many of the knees operated for infection were reoperated at some later date to get increased drainage. This should have been done in the first place, not after conditions are worse and the chance of favorable termination so much less. Of the seven fatal cases four were opened and reopened. Not that this is proof that an early more radical procedure would have changed the final outcome. The ever unknown relation between power of resistance and strength of infection prohibits such a deduction. But considering the possibilities, the extreme should be done at first to get the maximum amount of good at once.

Most cases are irrigated with some antiseptic. There is a happy medium between the amount of good done by an antiseptic and the amount of harm done to tissues. There is no question that carbolic and bichloride of mercury do destroy cells and diminish the function of others. Still, we do not feel that clinical evidence allows us to join the ranks of those who would discard these agents entirely for a purely mechanical cleansing agent, such as salt solution. We do not feel that the damage done to cells and their function is greater than the good derived from attenuating the virulence of the offending bacterium by the occasional use of some antiseptic. If we could, we would sterilize the entire cavity, cauterize it, and dress it aseptically as it were, to leave the process of healing to take care of the sterile dead tissue. For evident reasons this is not practical, and we believe that it is best to do the next thing, sterilize little by little with some antiseptic fluid and leave the body to replace the damaged cells. There are cases which go from bad to worse in spite of any cleansing agent or antiseptic, but we cannot believe that the process extended because of the use of an antiseptic which diminishes at least the virulence of the parasite.

In less acute cases the leg should have continual traction to prevent subluxation

Every infected knee is a huge abscess cavity with many pockets hard to drain. Any anterior incision can but poorly serve the purpose at best. We drain the top of the abscess but not the parts behind, neither do we drain any bursa which may happen to communicate with the joint. The bursa near the semimembranosus is the most often troublesome. It is our opinion that it is much better to keep these unfortunate people on their faces as much as possible, after making liberal drainage openings. If there are infected bursæ, these should always be opened. Various incisions have been used in the above cases, from complete transverse division to multiple openings front and back. Mildly infected joints, with moderate signs of infection where one is still in doubt as to the advisability of free open incision, should be treated as a synovitis by repeated aspirations. Certain joints will recover under this form of treatment even when the fluid withdrawn is very cloudy. It is the character of the fluid, not its macroscopic appearance, which is of importance. Should, however, the clinical signs indicate that the infection was progressing, then the utmost in the way of open operation should be done at once.

These figures represent the average conditions

To summarize, let us say

Non-penetrating injuries, penetrating injuries traumatic or operative and knees independent of any injury in the course of some other infectious process or not, may present signs and symptoms not to be distinguished in the absence of bacteriological examination from the cardinal signs and symptoms of infection.

Certain of these cases are undoubtedly infected, but the data at our command do not allow us to distinguish these from such as may be due to trauma and those possibly due to toxins secondary to infection elsewhere.

The knee-joint has certain germicidal powers

One out of every 22 operations upon clean knees becomes sufficiently infected to demand operation (4.6 per cent.)

One out of every 9 operations for recent (5 days) traumatic non-penetrating injury becomes sufficiently infected to demand operation (11 per cent)

One out of every 35 operations for pathological conditions other than traumatic injuries more than five days old becomes sufficiently infected to demand operation and draining the joint (29 per cent)

One out of every 22 operations for simple fracture of the patella becomes sufficiently infected to demand operation (46 per cent)

One out of every 71 operations for fracture of the patella done after the fifth day becomes sufficiently infected to demand operation (12 per cent)

One out of every 9 to 10 operations for fracture of the patella done before the fifth day becomes sufficiently infected to demand operation (105 per cent)

Three out of every five cases of penetrating injury to the knee-joint become sufficiently infected to demand operation (60 per cent)

Of compound fractures of the patella, seven out of nine become sufficiently infected to demand operation (78 per cent)

Certain knees subjected to non-penetrating injury and not operated become sufficiently infected to demand operation (10 per cent of the operated septic cases)

Certain knees become sufficiently infected to demand operation where no history of trauma exists or other evident septic focus in the body (13 per cent of the operated septic cases)

Certain knees become sufficiently infected to demand opening and draining the joint in the course of some evident focus of infection elsewhere in the body (11 per cent of the operated septic cases)

One out of every nine infected knees which have been opened and drained dies (11 per cent, some after previous amputation)

One out of every fifteen infected knees which have been

opened and drained comes to amputation before recovery (66 per cent )

One out of every thirty-one infected knees which have been opened and drained is resected (33 per cent )

Most knee-joints which have been infected, opened, drained, and recovered show varying degrees of functional disability, from slight limitation of motion to complete ankylosis with or without subluxation

The average stay in the hospital of an operated infected knee-joint is between two and three months

When it is once determined to open and drain a knee-joint, the operation should be as radical as possible at the start

The position of the leg should be that giving the best mechanical drainage, *i e* , the patient should be face down

The risk of infection is greatest in penetrating wounds of the knee (60 per cent )

The risk of infection is least in operations upon clean knees and where there has been no recent trauma (3 to 4 per cent )

# FIBROLIPOMA OF STOMACH

REMOVAL BY RESECTION OF STOMACH, CONVALESCENCE  
COMPLICATED BY TETANY

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SURGEONS are very rarely confronted with benign tumors of the stomach which are of non-inflammatory origin. They do not come to operation because in the majority of cases they are small and give rise to no symptoms. The benign tumors that are met with in the stomach are fibromata, fibrolipomata, lymphadenomata, and myomata. The last of these is probably the most frequent variety. Steiner,<sup>1</sup> who collected 51 cases of myomata of the gastro-intestinal tract, found 21 of the stomach. They arise from the muscularis, and grow either into the lumen of the stomach or towards the abdominal cavity. These tumors may attain a considerable size, and then give rise to symptoms merely because of their bulk. They may become inflamed or ulcerate, and thus create discomfort or even pain. Usually, they occur either at the larger or lesser curvature, and more rarely at the pyloric end. The diagnosis of benign neoplasm of the stomach is a difficult one. If they are palpable, and if they are known to have increased but slowly without interference with either the function of the stomach or the general health of the patient, the diagnosis can be made. Fibromata and fibrolipomata are usually small and produce no symptoms unless they become inflamed. However, I have been unable to find any cases recorded in literature in which an inflammation of such tumors has given rise to sufficient symptoms that warranted operation. I, therefore, may be permitted to report the following case that came under observation in the German Hospital. This case represents another interesting feature, namely, the development of tetany seventeen days after operation.

Mary S, thirty-seven years of age, was admitted to the hospital on February 23, 1904. Since January 17, 1904, she has suffered from attacks of pain in the abdomen, which occurred only during the day. The pain was of a dull aching character and varied considerably as to its site. Two weeks ago her physician found a small epigastric hernia and ordered an abdominal binder. This gave her no relief, the pains became more severe and localized in the epigastrium. Three days ago there was an acute attack of pain in the left umbilical region. It grew steadily worse, being sufficiently severe as to prevent her from sleeping. She has no nausea, and never vomited and has no cough.

*Status Præsens*—Fairly well nourished, anæmic looking girl with club-shaped fingers. Over the apex of the right lung there is some dulness, with a little exaggerated and high-pitched expiration, but the lungs are otherwise normal. The heart is normal. When patient coughs, a small soft mass protrudes in the linea alba, about one-fourth of an inch above umbilicus. It is of the size of a cherry and easily reducible, the hernial opening admitting the tip of a finger. In the left hypochondrium just below the ninth rib there is a point of considerable tenderness, the left rectus abdominis muscle is very rigid, but no definite mass is palpable. The right kidney is movable and can easily be felt. The left kidney cannot be palpated. On February 25, a splashing sound can be elicited just above and to the left of the umbilicus. Over this area tenderness persists. Lavage of the fasting stomach and after administration of Ewald's test-meal reveals normal conditions. But if the stomach is distended with water the pain becomes more severe, and lets up somewhat when the water is withdrawn.

As the pains did not subside by rest in bed and careful dieting, it was decided to operate the epigastric hernia, on the assumption that it was probably the main cause of her suffering, and at the same time to carefully explore the stomach.

Through the kindness of Dr O Kiliani, the case was referred to me for operation.

I operated on the patient on the 29th of February. A 5-centimetre incision was made in the linea alba over the hernia. On opening the sac, it was found to contain a small portion of adherent omentum. The adhesions were severed and the omentum replaced. On opening the abdomen, the stomach was found to be

freely movable The greater curvature, fundus, and pylorus were normal On the anterior wall of the stomach and encroaching on the lesser curvature, there was found a hard red mass, the size of a large walnut, projecting somewhat from the stomach wall The serous covering was of a dull red color and showed a number of dilated blood-vessels running towards the mass The lesser omentum was thickened by inflammatory processes and closely adherent to the mass On palpation the tumor seemed to involve the whole thickness of the stomach wall The picture presented the appearance of an ulcer at the lesser curvature about to perforate I therefore decided to excise the inflamed area, and resected a V-shaped piece of the anterior and posterior stomach wall, including the tumor The cut edges were then sutured in the usual way Examination showed that the mass originated from the muscular coat, the mucous membrane being entirely normal The microscopical examination made by Dr Weil showed the tumor to be a fibrolipoma with inflammatory changes and hæmorrhages in its substance For the first ten days the patient was nourished by means of nutrient enemata and by small quantities of fluid per mouth, which were gradually increased until the fourteenth day, when she took solids the first time

On the 17th of March, seventeen days after operation, she was suddenly seized with a severe paroxysm of pain during the night, located in the upper part of the abdomen and left hypochondrium At 3 30 in the morning she had a typical attack of tetany The spasms were limited to the upper extremities The wrist-joint became gradually flexed to an angle of over  $90^{\circ}$ , more marked on the right side There was a moderate flexion at the metacarpophalangeal joints, whereas the phalanges were extended The thumb was adducted and flexed into the palm of the hand The elbow-joint was flexed to about  $45^{\circ}$  There was a visible intermittent contraction of all muscles of forearm, arm, and the pectoral muscles, without, however, producing any motion in the joints After fifteen minutes' duration there could be noticed a gradual relaxation of the muscles on the left side, but the fibrillary twitchings still continued Tapping of cheek just under malar bone and in front of lobule of ear over the facial nerve produced contractions of orbicularis oris and drawing up of the angle of the mouth on the same side (Chvostek's symptom) There was a slight relaxation of the right elbow after nineteen



minutes Tetanic condition of right hand remained the same After twenty-two minutes there was an almost complete relaxation on both sides The fibrillary twitchings, however, in the affected muscles were still present After subsidence of the entire attack, we could easily produce a new tetanic condition of one arm by pressure upon vessels and nerves (Trousseau's phenomenon) Compression for one minute produced at first flexion at wrist, then at metacarpophalangeal joints and phalanges, and within two minutes a marked contraction at the elbow was brought about, being accompanied by considerable pain This tetanic condition, produced by pressure of the brachial vessels and nerves, was even more pronounced than the spontaneous tetanic spasms There was a marked adduction of the phalanges, the ring and little fingers being overlapped dorsally by the middle and index fingers The muscles of the lower extremities remained unaffected The electrical irritability of all the nerves of the upper extremity was greatly exaggerated, weak currents producing tetanic contractions

In the left hypochondrium, just below the ribs, a slight bulging could be noticed This spot was somewhat tender to palpation, and succussion could be heard over it A few friction sounds were also heard

During the course of the day the patient had four more attacks at 8 45 A M, 10 15 A M, 2 15 P M, and 10 45 P M They all lasted about twenty minutes

On March 18, Chvostek's and Trousseau's phenomena were still elicitable

March 19 Patient had no more tetanic attacks, but Chvostek's sign was still present Trousseau's sign, however, could not be produced after four minutes The patient complained of some tenderness about the scar and also in the left epigastrium

March 23 The patient felt well Chvostek's and Trousseau's phenomena have disappeared She complained of a dull and heavy feeling in left arm and forearm

During the few days when the patient had her tetanic attacks there was a slight rise of temperature ( $100-101^{\circ}$  F) The urine was somewhat decreased in quantity, but that was probably due to the restricted amount of fluids taken It was otherwise perfectly normal The percentage of chlorides fluctuated between 0.73 per cent (4.8 in twenty-four hours) to 1.5 per cent

The general condition of the patient was always good. The pulse was full, regular, and of good quality, the appetite was good, and *she never vomited*, nor did she have regurgitation of sour fluid or gas from the stomach.

Tetany (the name was introduced by Lucien Corvisart in 1852)<sup>2</sup> in gastro-intestinal derangements is not very frequent. According to Riegel (*Erkrankungen des Mageus* Teil I), there are about forty such cases reported in literature. Kussmaul was the first one to call attention to this complication in cases of motor insufficiency and gastric dilatation, caused by gastric ulcer and carcinoma of the pylorus associated with hypersecretion. Bouveret and Devic<sup>3</sup> thought that this hypersecretion was the main cause, and that gastric tetany occurred exclusively in this condition. But Fleiner, according to Kaufmann,<sup>4</sup> reported some cases where hypersecretion was absent. Four different theories were brought forward to explain these spasms.

1 *Kussmaul's Theory* He thought they were due to the loss of water from the tissues in the body, analogous to similar spasms occurring with Asiatic cholera and cholera nostras.

2 *Reflex Theory* There are some cases recorded in which spasms occurred after the use of the stomach-pump. Muller<sup>5</sup> observed a case where he could produce an attack by slightly tapping the region of the stomach.

3 *Intoxication Theory* This theory was advanced by Albu<sup>6</sup>. According to him, the resorption of toxins from the gastro-intestinal tract is to be held responsible.

4 *The Loss of Chlorides in the Tissues* This theory was advanced by Korszynski and Jaworski in 1891. To this theory very little attention has been paid by the various authors who have written on the subject. Sufficient importance to this theory is given only by J. Kaufmann in his admirable article on *Gastrosuccorrhœa*.<sup>7</sup>

In looking over the reported cases of tetany following gastric disturbances, the largest number was associated with

a large amount of hypersecretion of a gastric fluid, very rich in hydrochloric acid. At the same time the chlorides in the urine were diminished or entirely wanting. As the amount of food taken by these patients is very small, one can easily see that the loss of chlorides for the body can under such circumstances be large enough to seriously disturb the nutritive equilibrium of the tissues.

As we study the cases and try to explain them by the theories promulgated, we find that the same theory is not applicable to all cases. The idea that an intoxication is the main cause of these tetanic attacks has been accepted by a good many investigators. The rise of temperature that almost invariably accompanies the attack speaks in favor of this. In some regions, epidemics of tetany arise, as for instance in Vienna during the months of March and April<sup>8</sup>. Another strong point in favor of the intoxication theory is the possibility of saving a patient by gastro-enterostomy, thereby allowing the stagnated noxious masses in the stomach to be evacuated into the bowels and eliminated from the body.

Whatever the true cause of tetany in consequence of gastric disturbances may be, there is one striking feature about this disease, and that is its rarity. When we consider the large number of cases of motor insufficiency and hypersecretion of the stomach, from whatever cause, are yearly treated in private and hospital practice, the small number of tetany cases is surprising. The possibilities of exsiccation of the tissues, of reflex disturbances, intoxication, and loss of chlorides are given in almost every such case. All these causes, however, are not sufficient, there must be in addition a special vulnerability of the nervous system. If we analyze our case, there are some features of interest connected with it.

1 The attack came on after an operation upon the stomach.

2 The patient never suffered from any condition which is known to lead to tetany.

3 The attacks were light. The patient recovered entirely. Tetany in the course of severe gastric diseases usually

terminates fatally So far only a few cases have been saved by gastro-enterostomy The mortality, according to Riegel, is as high as 70 per cent The cause in our case was most probably also an intoxication When the attacks began, the patient had some bulging in the epigastrium, caused undoubtedly by a distended stomach One could hear the splashing of the fluid The cause of retention in our case was probably a motor insufficiency of the muscular wall of the stomach caused by the severe trauma of the operation This insufficiency was doubtless only a temporary one, for the patient never vomited In consequence of the irritation that the retained fluid exerted upon the muscular and nervous apparatus of the stomach, the muscular wall contracted and emptied its noxious contents through the patent pylorus into the intestine As soon as the poison was eliminated, the intoxication came to an end and the patient recovered entirely The amount of toxins must have been very small, but, as our patient was of a decided neurotic taint, it sufficed to produce enough irritation upon her easily vulnerable nervous system to lead to an attack of tetany

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- <sup>3</sup> Cit after Riegel
- <sup>4</sup> F Kaufmann Remarks on Gastrosuccorrhœa, etc, American Journal of the Medical Sciences, April, 1904
- <sup>5</sup> Cit after Riegel
- <sup>6</sup> Archiv f Verdauungskrankheiten, Band iv
- <sup>7</sup> Loc cit
- <sup>8</sup> Oppenheim Lehrbuch d Nervenkrankheiten

# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY

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*Stated Meeting, April 26, 1905*

The President, HOWARD LILIENTHAL, M D, in the Chair

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### VOLVULUS

DR F TILDEN BROWN presented a man of forty years, who when he was eight months old had an attack of what was probably anterior poliomyelitis, with complications affecting the right foot and leg, which at the age of twenty necessitated an operation on that extremity. He stated that previous to that operation his bowels had always been regular, but since then he had been troubled very much with constipation.

About a year ago, he began to have occasional attacks of abdominal disturbance, with flatus. He had such an attack two months ago, and for eight days he had no faecal movement, although flatus was expelled. The bowels finally acted after various cathartics had been used. Since then his bowels had moved about once a week until ten days ago, when he had his last dejection previous to his admission to the hospital. Flatus had been passed three days ago. During the past year he had lost considerable weight.

Upon admission to the hospital, the physical examination was negative, with the exception of the fact that the abdomen was hugely distended. There was no nausea. The temperature was 100° F, pulse and respiration normal. Leucocyte count normal. There was a trace of albumen in the urine. No mass nor signs of fluid in the abdomen could be made out. There was no abdominal pain nor tenderness.

*Operation* — Though a median incision, the enormously distended colon was exposed. It was fully nine or ten inches in diameter, and occupied nearly the whole of the abdominal cavity. In the pelvic region, the distended gut seemed to be constricted by a tense, cordlike band, which extended from the right to the left of the sacrum. The largest sized trocar and cannula was inserted into the distended gut for the purpose of withdrawing the collection of fæces, but this method proving too slow, an incision was made into the bowel, and two bucketfuls of fæces evacuated. The incision in the bowel was then closed by a series of sutures, and after untwisting the coiled intestine, the supposed constriction referred to above was found to have disappeared.

The subsequent history of the patient was uneventful. He had his first voluntary movement on the sixth day, and from that time on his condition steadily improved.

DR H LILIENTHAL said that in a case which he showed before the Society some years ago, in which he had pursued practically the same method as that described by Dr Brown, namely, evacuated the gut, which was distended to about the size of an adult thigh, he sutured the intestine to the wound, and in that instance there was no recurrence. The question of the after-treatment of these cases was in a somewhat unsettled state. Some were in favor of taking steps to prevent a recurrence of the volvulus, while others claimed that a recurrence might occur in spite of anything that could be done to prevent it.

DR BROWN said he had taken no steps to prevent a recurrence in the case he had shown. Thus far there were no signs of such a recurrence, but the belly was large and flaccid, and a recurrence was of course possible.

DR JOHN F ERDMANN said that six years ago he had a case in which he fastened the gut to the side of the abdominal wall, and there was no trouble in the future. Recently, he saw another case in which the sigmoid was enormously dilated, twenty-two inches in circumference, and three feet and nine and one-half inches long. In that case he also attached the emptied gut to the abdominal wall. Three weeks ago the patient had a similar attack, which was relieved by position and enema. The cause of the last obstruction was unknown.

## INTUSSUSCEPTION

DR THEODORE DUNHAM presented an infant of four months, who was admitted to the Babies' Wards of the Post-Graduate Hospital on the 29th of January, 1905. The child's previous history was good, with the exception of an attack of bronchopneumonia last December. It had always been breast-fed, helped out by the bottle, and had been inclined to be constipated ever since birth.

The immediate history was that, thirty-five hours before admission, the child had suddenly become sick, crying out as though in pain. This was followed by a painful movement, containing mucus and bright red blood. Five similar stools had occurred up to the time of the child's admission, and one afterwards, which was particularly bloody. The child had been feverish, there was no history of vomiting, no convulsions, the urine was negative. The stools during the previous twenty-six hours had contained no fecal matter, simply mucus and blood.

On admission, a mass was felt in the upper left quadrant of the abdomen, about three inches long and an inch and a half wide. It was evidently an intussusception, and some effort was made to reduce it by means of enema, but this method was unsuccessful and was quickly abandoned.

*Operation*—An incision was made in the median line from the symphysis to just above the umbilicus. After protecting the intestines with hot compresses, the seat of the trouble was located in the caput coli, some eight or ten inches of ileum being invaginated into the cæcum. The intussusception was reduced in about fifteen minutes by gentle manipulation, gradually milking out the invaginated portion. The gut was very tense and congested, and in the course of the reduction the peritoneal covering was repeatedly torn. No sutures were applied to the intestines.

During the operation and on the night following it, the child was in a very precarious condition, requiring free and repeated stimulation with camphor, whiskey, and strychnine. During the evening, it several times vomited a dark, greenish fluid. The temperature became normal on the third day, and remained so. Further recovery was uneventful. The child's constipation has gradually improved. For several weeks past an occasional teaspoonful of sweet oil is the only laxative needed. The child is in fine health.

DR. GEORGE E. BREWER said that in the reduction of three cases of intussusception that had come under his observation, very little had been accomplished by traction on the invaginated gut. Reduction was accomplished by the method described by Dr. Dunham, *i e*, gently milking and squeezing out the confined intestine.

DR. DUNHAM said he had a case where the tumor was on the left side of the abdomen, and after several high enemas it apparently disappeared entirely. No fecal matter was elicited by the enemas, however, and upon opening the abdomen he found that the intussusception tumor had concealed itself under the liver.

DR. LILIENTHAL called attention to the danger of giving young children strychnine after surgical operations, especially in acute cases. At times it gave rise to twitching and convulsions, and might even determine the fatal ending instead of acting as a true stimulant.

DR. ARTHUR L. FISK mentioned a case reported by Dr. Erdmann where the child suddenly died twenty-four or forty-eight hours after the intussusception had been perfectly reduced. The speaker said that he had had a similar experience, where the autopsy had showed no recurrence of the invagination or any cause of death. Death, in these cases, was probably the result of shock, and possibly in the case presented by Dr. Dunham it was the strychnine that had carried the child to recovery. The early nursing of the infant was also of great assistance. Warmth and warm, easily digested and stimulating nourishment are of great importance in preventing such unfortunate an outcome.

#### RETENTION METHOD AFTER HARELIP OPERATIONS

DR. THEODORE DUNHAM presented two children to illustrate the use of a new retention method after harelip operations. In the application of this method, the materials required are two narrow strips of chiffon cloth, a strand of silkworm gut, and flexible collodion. Fig. 1 shows the device being applied. One end of a strip of the chiffon cloth is pasted to the cheek with collodion, beginning with the end of the strip out on the cheek and pasting it as far inward as the angle of the mouth, as shown at *A*. The silkworm gut, *B*, is then laid over the parted chiffon at the point



where the pasting was stopped, the free part of the strip, *C*, is folded back and pasted down upon *A*. The appearance then is

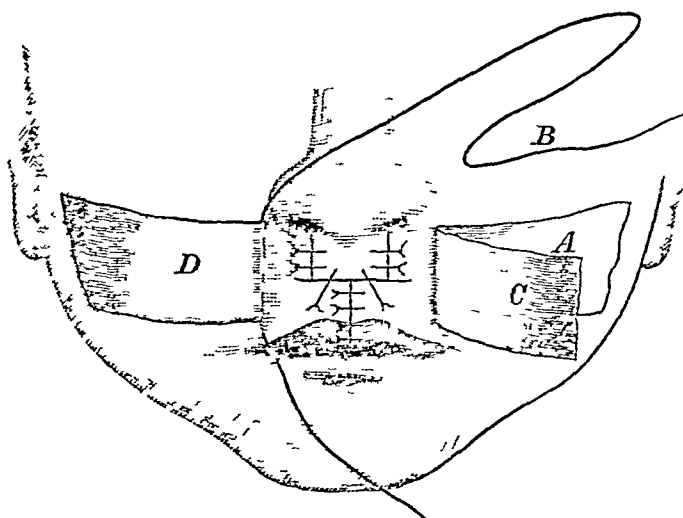


FIG 1—Retention straps for harelip, first step of application

as represented at *D*. The strand of silkworm gut is thus secured on each side. The silkworm gut is so smooth that it slides easily

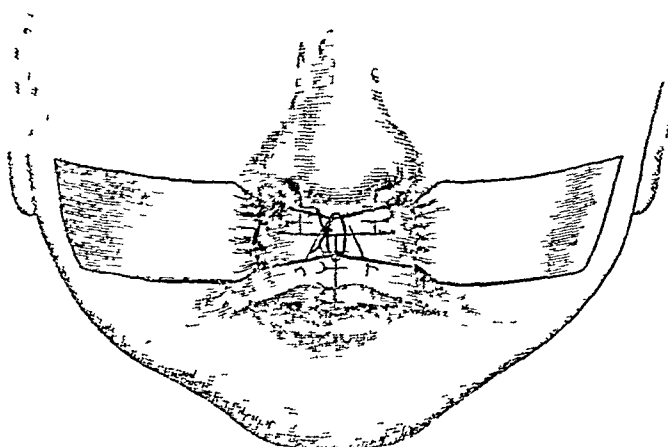


FIG 2—Retention straps for harelip, the application completed

through the bight of the chiffon cloth. When the collodion is dry, which it will be in a very few minutes, the ends of the silkworm gut are tied together below. In tying, enough tension is

made to take off all strain from the sutures and to develop slight folds running from the wings of the nose to the corners of the mouth. The degree of tension may be gauged to a nicety. After the knot has been tied, one of the loose ends is thrown round the upper half of the silkworm-gut loop and tied to the other loose end. This draws the upper half down from the nostrils and the lower half up from the margin of the lip. This completes the method, and the appearance is as shown in Fig 2. If it is found that the silkworm gut presses rather strongly on the lip, it may be wrapped with a bit of chiffon cloth and some ointment put on the chiffon cloth. The ointment will stick the chiffon cloth in place, and the chiffon cloth will adequately distribute the pressure.

The chief points of merit of this method over some others are that it permits strong retention and allows it to be accurately applied, no wound is made, no sutures are under any special tension, and thus stitch-hole infection is less likely to occur, the field of opposition is exposed to view and can be kept clean during healing. This device should be kept applied till three weeks have elapsed since operation, for it takes that lapse of time for the union to become firm enough to resist the influences which tend to broaden it. In the first case, a boy, nine months old, with a double harelip, he operated April 1, 1905, at the Post-Graduate Hospital. He utilized the premaxillary lip and caused the lateral portions to meet below it in the median line. To secure proper relaxation, he made a horizontal cut through each lateral half. He did not free the cheeks from the maxilla, silkworm gut and horsehair sutures were used. Directly after operation he washed out the stomach. When the lips were dry the retention device was applied. The sutures were removed in a week, and the retention device at the end of nineteen days. Specially notable in this case was the linear character of the scars of apposition, and the fact that this was accomplished without lifting the cheeks from the jaw to gain relaxation. The perfect retention maintained relaxation without elevation of the cheeks. The second case, a male, four months old, entered the Babies' Wards of the Post-Graduate Hospital, April 13, 1905. He had been admitted two months previously, but was then too emaciated and sickly for operation. The two intervening months he spent at Morristown and returned to the hospital much improved,

though weighing only six and one-quarter pounds. On the left side was a single harelip and a cleft through both hard and soft palates, and on the right side a cleft through the soft palate only. The gap in the alveolar process was unusually wide, and the intermaxillary portion greatly tilted out of line. The operation was done April 14. Passing a knife into the alveolar process from in front, he partly severed the premaxillary portion from the rest and partly cut the hard palate. He then elevated a muco-periosteal flap from the septum nasi in the cleft on the left side and partly cut through the vomer. By pressure he was then able to twist the premaxillary portion of the alveolar process down rather well into place. The left wing of the nose was then freed from the jaw-bone. When this had been done, it was possible to pass a silkworm-gut suture through the two margins of the alveolar process, binding together the edges of the alveolar cleft, the opposing surfaces of which were freshened before approximation. This procedure brought the nose into the mid-line of the face. The margins of the gap in the lip were then trimmed and united. As soon as this had been done, the stomach was washed and a considerable amount of blood-clot removed. For many years he has made it a practice to wash the stomach immediately following harelip operations. He regarded the removal of this blood from the stomach of these frail infants as of very great importance, and he believed that many cases not so treated die from an acute indigestion due to the presence of this blood. A few hours after operation, the retention method was applied to approximate the cheeks and take off tension from the sutures. At the end of six days the sutures were removed from the lip. In this case, also, the linear character of the scar was noticeable.

At the meeting of the Surgical Society held on May 10, Dr. Dunham again showed this case. It had gained four ounces since operation. The retention device had been removed at the end of twenty-one days, and also the suture through the alveolar process. He called attention to the fact that the alveolar process remained as it had been moulded at operation, to the linear character of the scar in the lip, to the fact that, in spite of the rather extensive work on the bony and soft parts, no infection had occurred, and he felt that these results in so frail a patient were largely due to the perfect relaxation afforded by the new retention method.

DR BREWER recalled a case where death followed a simple operation for single haemip, and where the fatal result might possibly have been due to the cause suggested by Dr Dunham, namely, the blood left in the stomach. The operation was done under a few whiffs of chloroform, it only occupied a few minutes, and the child left the table in good condition. There was very little loss of blood. Within six hours after the operation, the temperature rose to  $106.5^{\circ}\text{F}$ , the child became unconscious, and remained so until the end. Death was attributed to the status lymphaticus, but no positive conclusion was reached.

### ACUTE HÆMORRHAGIC HEPATITIS

DR CHARLES H. PECK presented a man, twenty-three years of age, who was admitted to Roosevelt Hospital Medical Division, on March 30, 1905, with the following history. Two days ago patient was waked up by a sudden, sharp, stabbing pain in region of gall-bladder, not radiating, constant, increased by inspiration. With this pain he had at first headache and constipation, but no nausea nor vomiting and no cough. The pain has continued ever since severe enough to keep him awake at night. His temperature on admission was  $103.8^{\circ}\text{F}$ , pulse, 112, respiration, 30. Physical examination showed slight dulness low in right axilla, pulmonary and cardiac signs were normal, on the following day (March 31, 1905) a few dry crepitant râles were heard in right anterior axillary line, low down. Entire abdomen was somewhat rigid, right side more so than left, especially over upper half of right rectus, where there was also tenderness. Neither liver nor spleen could be felt. A very slight icteric tinge was noted in conjunctivæ and skin of abdomen, so slight that there was a difference of opinion as to its presence.

On April 1 there is a note that general condition was better, pleuritic râles about the same. April 2 the patient said that the pain suddenly left him during the night, its disappearance being similar to the sudden onset. Tenderness in right hypochondrium was also better. The course continued about the same, except that some tenderness developed lower down, over the region of the appendix, until the time of his transfer to the first Surgical Division, service of Dr Brewer, on April 4, with a diagnosis of appendicitis.

On admission to the surgical ward there was no jaundice, a few râles in right axilla, some general abdominal tenderness on deep pressure, most marked over right rectus as low as region of appendix, some pain in right hypochondrium. On April 7 pain was much less, he was allowed out of bed. The diagnosis at this time was still probable appendicitis, with subsidence of acute symptoms, and appendicectomy was advised.

On April 8 there was some return of pain, temperature was then normal, 98.2° to 98.6° F, pulse, 76, respiration, 20. Patient consented to the operation, which was performed by Dr Seth Milliken, Jr, House Surgeon, under the direction of Dr Peck.

On opening the peritoneum, some fresh, rather dark blood escaped, and kept oozing out from the peritoneal cavity as search was made for the appendix. Cæcum and appendix, together with an adherent portion of omentum, were drawn into the wound without great difficulty. The peritoneum of cæcum, region of appendix, ascending colon and tip of omentum were discolored by the blood in peritoneal cavity, dulled and slightly roughened, presenting the appearance of a mild, plastic peritonitis. The appendix was removed in the usual way and stump inverted, it did not appear to be diseased. A small portion of thickened, ecchymotic omentum was excised. Fresh looking dark blood continued to come from peritoneum, apparently from region of liver, no bleeding points could be found. The edge of liver could be felt through wound, it seemed very soft, blunt, and about three inches below free border of ribs, a good deal of blood followed withdrawal of finger after palpating in this region.

The appendix wound was covered and a five-inch vertical Kammerer incision made over upper part of right rectus. The liver presented in the wound, its upper surface was adherent to diaphragm in its entire extent, its under surface to transverse colon and mesocolon. The adhesions everywhere were very soft, easily separated, and uniform. The liver was uniformly enlarged, both lobes, the interlobular notch much deepened, the free edge blunt and rounded, the consistence very soft, but uniformly so. Handling of the liver and separating adhesions, though done with extreme caution and gentleness, resulted in a good deal of general oozing of blood. The gall-bladder seemed perfectly normal and was full of bile, the adhesions surrounding it seemed exactly

like those everywhere present The pancreas was carefully palpated and felt firm and perfectly normal The hand, swept well up between liver and diaphragm, found the same uniform, soft, adhesions everywhere, but nothing suggesting abscess or a localized process at any point The under surface of liver everywhere presented the same condition, the enlargement, soft spongy feel, and recent adhesions seemed absolutely uniform The liver edge was fully three inches below the free border of ribs Blood continued to collect in region of hepatic flexure and along ascending colon in moderate amount A large cigarette drain was carried upward to under surface of liver from appendix wound, and the rest of the wound closed by layers with catgut and silk The upper laparotomy wound was closed by layers without drainage, with catgut, silkworm gut, and silk Time, one hour Condition good

Urine examinations were as follows

March 31 Amber, cloudy, clear, light flocculent precipitate, 1022, acid, faint trace of albumen No sugar, no indican Diazo reaction negative No bile Many hyaline and granular casts, mucus, and epithelium

April 1 Thirty ounces in twenty-four hours Amber, clear, light flocculent precipitate, 1026, acid, faint trace of albumen No bile, a trace of urobilin, granular casts

April 4 A faint trace of albumen, a few hyaline and granular casts

April 9 No albumen, no casts

Leucocyte counts

On admission, 14,600, April 1, 14,200, 2, 15,200, 9, 18,000, 15, 29,000

Differential count, polymorphonuclear, 78 per cent, lymphocytes, 21 per cent, eosinophiles, 0.5 per cent, basophiles, 0.5 per cent Red cells normal, 4,800,000

Convalescence was uneventful, wounds healed by primary union except at point of drainage, drain was removed on the third day and replaced only through abdominal wall A furuncle on cheek was responsible for the slight rise of temperature and high leucocyte count on the sixth day after operation All stitches were removed on ninth day Allowed up on the twelfth day Liver edge could not be palpated at this time, and percussion showed dulness extending only a short distance below free

border Patient seems to have entirely recovered and feels perfectly well

Dr Peck remarked that the picture that the case presented was evidently one of an acute infection, probably from absorption of some toxic material from the gastro-intestinal tract acting as a direct poison on the liver-cells through the portal circulation. The history throws no light on the possible source of this toxæmia, careful questioning failed to elicit any history of the ingestion of any unusually indigestible food, drink, or toxic substance of any kind. The attack was not preceded nor accompanied by gastro-intestinal symptoms. It presented none of the characteristics of the ordinary attack of acute cholangitis, and the condition of the liver at the time of operation, *ie*, uniform recent adhesions, spongy general swelling, and spontaneous oozing of blood, would indicate a process affecting the parenchyma rather than the ducts. The presence of albumen and casts in the urine, the sharp course of the temperature, and the spontaneous oozing of blood from the liver substance into the peritoneal cavity in sufficient quantity to cause a mild grade of plastic peritonitis along the line of the colon, cæcum, and region of the appendix with the accompanying tenderness which led to a diagnosis of appendicitis, all show the degree of severity of the original toxæmia, whatever the source may have been.

The diagnosis of acute hæmorrhagic hepatitis is used simply in a descriptive sense. He had been unable as yet in a very imperfect search of the literature to find any record of a similar condition, nor had the many colleagues, both surgeons and physicians, to whom he had spoken in regard to the matter, ever encountered a similar case.

#### RESECTION OF ILEOCÆCAL JUNCTION, THE ASCENDING, AND PART OF THE TRANSVERSE COLON FOR FÆCAL FISTULA

DR CHARLES H PECK presented a man, thirty-five years old, a laborer, who was operated upon for appendicitis, with abscess, October 1, 1904, a fæcal fistula developed and has persisted ever since. An attempt was made to close it by operation on January 26, 1905, resulting in complete failure. At that time, in spite of a long and careful search and a good exposure of the cæcum and colon nearly up to the hepatic flexure, he was unable

to definitely locate the opening in the bowel, no faecal matter escaped during the operation, which was terminated by simply establishing direct drainage down to the supposed site of the opening in the gut. Faecal discharge continued unabated, methylene blue injected per rectum escaped promptly from the sinus, proving it to be in the large intestine.

The second operation was performed March 22, 1905.

Operation, ether. Old sinus carefully wiped out with sterile tape, and then filled with liquid paraffin injected through a silver catheter, which solidified immediately. Opening of sinus then packed with sterile gauze, and a long vertical incision made over outer part of right rectus, opening peritoneal cavity, and carried upward nearly to border of ribs. Solidified paraffin could be palpated through parietal peritoneum running upward to outer side of and behind colon, nearly as high as hepatic flexure, adhesions were separated, and the ascending colon carefully lifted from its bed and turned towards the right, at a point high in the posterior wall the paraffin was reached, where the sinus penetrated the wall of the gut, the colon was further freed in the attempt to get room to suture the opening in the bowel, during the separation of firm adhesions, a tear was made into the cæcum, and through this a stricture in the ascending colon was discovered, barely admitting the finger. Resection was deemed imperative, in spite of the poor condition of the patient. The ileum was divided about two inches above the ileocæcal junction, a segment of a Murphy button slipped into the lumen, and the end closed with a purse-string suture of heavy silk, reinforced by two tiers of Lembert's. After completing the separation of the ascending colon and hepatic flexure, ligating the vessels of the mesentery, and dividing it, the resection was made through the transverse colon, well beyond the zone of thickening and adhesions, and the diseased gut removed, it included the ileocæcal junction, the entire ascending colon and hepatic flexure, and a portion of the transverse colon. The cut end of the transverse colon was then closed by a silk purse-string suture reinforced by two tiers of Lembert's, after inserting the Murphy button in its lumen. The shafts of the button were then brought through the side walls of the gut through small incisions, and lateral anastomosis made, reinforced by a circular catgut Lembert. Operative area was cleansed with peroxide and flushed with salt solution. Two large



cigarette drains were placed in upper angle of wound and the abdominal wall closed by layers, with catgut, silkworm gut, and silk. The old sinus was not treated, the paraffin was left in place. Time of operation about one and one-half hours, the patient's condition was very poor. He was given an intravenous saline infusion of 2000 cubic centimetres on the operating table, during the resection, with marked improvement of the pulse. Also strychnine, one-thirtieth grain, by hypodermic injection.

Patient rallied nicely from the shock with very moderate stimulation. The old sinus was dressed frequently after the second day, the paraffin coming away in flakes during the first few dressings. There was never any faecal leakage, the wound healed without infection, with the exception of a small stitch abscess, the drainage opening closed rapidly. The old sinus healed more slowly, but steadily, and is now practically closed.

#### HÆMATURIA

DR F TILDEN BROWN read a paper with the above title.

DR ELLSWORTH ELIOT said that during the past four or five years he had observed from time to time a condition for which he could not ascribe any cause, and which, for the want of a better name, he had called idiopathic perinephritis. The condition was one in which the kidney was found embedded in its fatty capsule, and firmly adherent to its fibrous capsule. The symptoms were recurrent hæmaturia, sometimes associated with severe pain, but without albumen or other indication of a kidney lesion. In the last case that came under Dr Eliot's observation, the bleeding recurred every day for a period of two or three weeks, and quickly disappeared after operative interference. In that case, as well as in others where the symptoms were not so pronounced, the pain and hæmaturia disappeared after division of the fibrous capsule, and suture of the outer edge of the capsule to the transversalis fascia, as was done in floating kidney.

DR BROWN said he had seen a hæmorrhagic separation of the renal cortex from the renal capsule, but he did not recall that there was any surrounding effusion or hæmaturia associated with it. He had never met with the condition described by Dr Eliot.

DR LILIENTHAL said that at various times he had reported

cases where he had operated for the relief of hæmaturia, and he still held the view that, in cases of obscure hæmaturia, a nephrotomy should unquestionably be undertaken. If it turned out to be an ordinary hæmaturia, no harm had been done. In one case that was already on record, the patient was a woman whose death resulted from a pure hæmorrhagic nephritis. In her case, the cystoscope was first introduced into the bladder, but it failed to give any information on account of the free hæmorrhage. A suprapubic section was then made, and the blood was found coming in enormous jets from the right ureter. The kidney on that side was then exposed and incised into its pelvis with negative results. The patient died on the following day of acute anæmia, and at the autopsy a minute examination of the entire urinary tract failed to reveal the cause of the hæmorrhage. The diagnosis of hæmorrhagic nephritis was made after a careful microscopic examination. The bleeding in hæmorrhagic nephritis may frequently be checked by nephrotomy.

DR BREWER mentioned a case of symptomless hæmaturia in which, upon operation, he found a beginning carcinoma. The man was still alive five years after the operation.

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*Stated Meeting, May 10, 1905*

DR GEORGE WOOLSEY, President *pro tem*

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#### CICATRICIAL STRICTURE OF THE ŒSOPHAGUS TREATED BY THE STRING METHOD

DR WILLY MEYER presented a boy, three years old, who in May, 1904, swallowed some caustic lye. His mother immediately induced him to vomit, and he was then taken to a hospital, where he remained for a number of weeks, and was treated by the use of œsophageal bougies. When he left the hospital, he was instructed to report at regular intervals, which his mother failed to do.

When Dr Meyer first saw the boy, early last November, he had a fairly tight œsophageal stricture. He had been unable to swallow solid food for some time, and was scarcely able to swallow liquids. On November 14, Dr Meyer did a gastrostomy, following Kader's method. As the boy refused to swallow a thread, subsequently a long filiform black bougie was introduced into the stomach from above, its lower end located by means of the electric cystoscope and grasped with a properly curved forceps which had been passed through the gastric fistula. A silk thread was then pulled through from the gastric fistula out of the mouth and its ends fastened to the skin with gut plaster. A few days later a stout fish-line was attached to the string and drawn through from the mouth to the gastrostomy wound, and now the stricture was cut until a No. 32 instrument could be introduced with comparative ease. Dr Dunham's instruments were again used to great advantage.

A second patient, also a boy of three years, was presented who had acquired his œsophageal stricture by swallowing caustic lye. The same method of passing the thread and cutting the stricture was followed in this case, and the result was equally satisfactory. The method of passing the thread from the mouth through the gastric fistula, the key to the situation, as described above, is original, and seems to represent a useful addition to our resources in these cases. It is of importance that an assistant takes hold of the end of the bougie projecting from the mouth. He will immediately feel and give notice when the forceps has grasped the gastric end of the bougie. Of course, the method is applicable to such cases only in which a filiform can be made to pass through the stricture into the stomach. Both children are in good condition to-day and able to swallow any kind of food. Both gained materially in weight. In one of them the gastrostomy wound had healed promptly after the tube was left out permanently, in the other there was still a slight leakage, which Dr Meyer said he expected to remedy at a subsequent operation.

DR ROBERT ABBE said that in some of these cases the strictured tissue became so firmly organized that it was a matter of great difficulty to penetrate it either from above or below. Quite recently he saw a case in which the stricture extended over a distance of three or four inches. The patient was seen by Dr Keen, who was unable to pass even the finest filiform, and by Dr

Deaver, of Philadelphia, who kindly referred the case to Dr Abbe. It was impossible to enter the stricture from above, and for three days no fluid had been swallowed. After a gastrostomy, he was able to introduce a long, fine whalebone filiform from below, and within ten minutes easily cut the strictures by the string method up to the size of a large finger. He left the gastrostomy wound open, and the subsequent train of events led him to doubt the wisdom of that procedure. For two weeks he kept the wound under good control, then it began to show a tendency to pout, and was constantly bathed in gastric juice. As a result of this, the patient became emaciated so rapidly that it was necessary to do a laparotomy and close the gastric fistula by the inversion method. During this period it was necessary to intermit the dilatation of the stricture, and in ten days it had recontracted to such an extent that a small bougie could not be safely passed. Dilatation was finally again accomplished by means of a special instrument which he devised for the purpose, and has been readily maintained.

Dr Abbe said that the first case of œsophageal stricture upon which he operated by the string method thirteen years ago remains absolutely well, and reports to him about once a year for the purpose of having the largest sized bougie passed in order to test the caliber of the œsophagus. No stricture can be detected.

DR JOHN A. HARTWELL said that in a case of œsophageal stricture that he showed last fall, and which he treated by the Dunham method, the child at first refused to swallow the thread, but after starving him for twelve hours he consented to do so, and it was washed through the stricture without any trouble.

DR MEYER, in closing, said that, with the exception of this one case, he had never before had any trouble with the spontaneous closure of a gastric fistula established according to Kader's or Witzel's method. The slight leakage in this instance following the removal of the tube was due to a pressure-necrosis made through the gastric fistula by the string, which had been drawn too tightly. The speaker said he was not in favor of doing the operation at one sitting, the gastrostomy should be done first, and the cutting and dilatation of the stricture subsequently.

DR WOOLSEY suggested that the string could have been prevented from cutting the gastric fistula by passing it through the tube introduced into the gastrostomy wound.

EXCISION OF THE RECTUM FOR CARCINOMA BY THE  
WITZEL-HOFFMAN METHOD

DR MEYER presented a woman, thirty-eight years old, who was operated on by him at the German Hospital on November 30, 1904, for an ulcerative carcinoma of the rectum, about two inches above the anus

In undertaking an operation for this condition, Dr Meyer said, one had to consider the Kraske method, and its modifications, and also the abdominal method in cancers situated high up. In addition to these methods, Witzel, about three years ago, advised the total excision of the lower section of the bowel without preservation of the anal ring and the formation of a gluteal anus. He claimed that any attempt made to save the lower end of the bowel by resection usually proved futile, on account of the difficulty of obtaining perfect union, and the interference with its nerve supply. For that reason, he favored excision of the lower segment, together with the diseased portion, then opening the peritoneum widely and pulling down the sigmoid.

In doing this operation, the anus is first closed with a double row of silver-wire sutures, and the os coccyx excised, the sacrum is left intact. Then the rectum is loosened posteriorly. After opening the peritoneal cavity, the inferior, middle, and superior hæmorrhoidal arteries are primarily ligated, thus obviating the danger of serious hæmorrhage. The gut can now be pulled down many inches. After tamponing carefully the free peritoneal cavity to prevent infection, the diseased section of the gut, together with the lower segment, is removed under aseptic precautions. In this instance the bowel was left within the large wound according to the modifications devised by Hoffman, one of Witzel's pupils. In the course of wound healing the stump retracted more than anticipated, necessitating a resection of the lower end of the sacrum. To-day conditions are very satisfactory. Patient has gained much in weight. In another case of this kind, operated on within the last few weeks, Dr Meyer has closely adhered to the method laid down by Witzel, forming a gluteal anus. He has been much pleased with the result, and trusts to be able to present the patient before the Society in the fall.

## ' SARCOMA OF THE UPPER JAW

DR ROBERT ABBE presented a man, seventy-two years old, who nine years ago developed a growth on the anterior part of the upper jaw, bulging forward in the canine fossa, and protruding from the right nostril

After a preliminary simultaneous ligation of both external carotids, which up to that time, Dr Abbe said, had not been done to his knowledge for the purpose of controlling hæmorrhage, a complete resection of the upper jaw was done. On account of the involvement of the hard palate, it was necessary to remove a large portion of the septum and a part of the opposite side of the hard palate and the inferior turbinated bone. The growth proved to be a sarcoma. There were no signs of a recurrence after nine years. An artificial plate had been substituted for the superior maxilla, greatly improving the deformity caused by the operation, and restoring speech to normal.

DR WILLIAM B COLEY called attention to the fact that sarcoma of the jaw often recurred after very long intervals. He recalled one case of sarcoma of the lower jaw in which there was no recurrence after five years, and another after ten years. Since the meeting, he has just seen a third case with a large local recurrence seventeen years after excision.

FINAL RESULTS IN THE X-RAY TREATMENT OF CANCER,  
INCLUDING SARCOMA

DR WILLIAM B COLEY read a paper with the above title for which see page 161.

DR ARTHUR L FISK said that he had used the X-rays for many years upon epitheliomatous and sarcomatous growths, and that at first he had regarded the effect of the rays as beneficial, even in some cases as curative. But there had always been a subsequent recurrence, and it seemed as though the advance of this growth was more rapid, and, also, extensive, in the cases in which the X-rays had been used than in those in which they had not been used. For this reason, Dr Fisk said, he had come to the opinion that the use of the rays was harmful even in cases which had been operated upon, because the persistent use of the rays appeared to diminish the resisting power of the tissues, in a measure to devitalize them. Therefore treatment by the X-rays

should be reserved for only the absolutely inoperable cases, and then used because of the courage and hope which the patient obtained

DR CHARLES N DOWD said that he had had the opportunity of watching the work which was done at the General Memorial Hospital under Dr Coley's direction, and that he believed that the very just and impartial statement which Dr Coley had made was a valuable contribution to our knowledge of the value of the X-ray treatment of malignant tumors. He had seen one case of superficial epithelioma in which the X-ray treatment was very satisfactory. The patient was first seen about four years ago, she then had a small superficial epithelioma involving the ala of the nose, which had already been under treatment for two or three years. Any operative procedure would have necessitated removal of the ala, and left a decided deformity. The lesion was first treated by caustics and subsequently by the X-rays, and entirely disappeared. Eighteen months ago there was a slight recurrence, which again disappeared under the use of the X-rays, and there has been no subsequent evidence of its return.

DR ROBERT ABBE said he was not quite as pessimistic regarding the value of the X-rays as were the previous speakers, particularly when this measure is used for the purpose of prolonging life in cases of carcinoma that were going from bad to worse. The speaker said that in one case of cancer of the lip that had disappeared with the use of Rontgen rays, three years had elapsed without a recurrence. In that instance, no microscopic examination had been made, but the clinical appearance left no doubt of the diagnosis. A strikingly beneficial effect of the X-rays was often observed in cases of advanced, ulcerating cancer of the breast which was beyond operative interference, and in which there was glandular enlargement, cachexia, hæmorrhage, and exhaustion. In one such case coming under his observation, where the patient apparently could not have survived a month, life was prolonged for two years as a result of the X-ray treatment. Under the influence of the rays, the massive carcinoma dwindled and finally became a little flat cake of scirrhous tissue. The cachexia disappeared, the patient gained in strength, and was in the enjoyment of fair health until the following year, when there was a secondary invasion of the pleura and mediastinum, which ultimately proved fatal.

In another case of cancer of the breast, with extensive axillary involvement, in which the diagnosis was confirmed microscopically by Dr E K Dunham, a very complete operation was done seven years ago. Following the operation, there was œdema of the arm for two years. Five years later a recurrence took place in the line of the scar and under the clavicle. Persistent X-ray treatment was begun, the exposures being of ten minutes each, and repeated twice weekly. Under this treatment, the recurrent nodules disappeared. Subsequently, she developed a cough, with signs of metastatic involvement of the mediastinum. She was again exposed to the X-rays, and under this treatment her cough disappeared, and the lungs entirely cleared up. For one year no physical evidence could be found in any part of the patient's body. A few days ago the woman died of acute nephritis after two weeks' illness. Autopsy made carefully by Dr F C Wood showed absolutely no trace of malignant tissue in the pleura, mediastinum, lungs, liver, kidneys, or elsewhere in the body. The X-rays seemed to be particularly effective in dissipating superficial cancers, such as cancer *en cunasse* of the breast, where it sometimes had a marvellous effect in bringing about retrograde changes in the nodules, and apparently devitalizing the cells so that they cease producing toxins, as evidenced by the disappearance of cachexia and return of color to the cheeks.

Sometimes, Dr Abbe said, the inefficiency of the X-rays could be traced to the tube used. Some long-used tubes worked apparently well with the fluoroscope, yet a change to a brand new tube would bring about strikingly better results. We were still in comparative ignorance of the nature and possibilities of the Rontgen rays, and to discard them entirely as a therapeutic agent would be a serious mistake. We have no more right to refuse this agent to a sufferer on the ground that it does not often make radical cures, than we have to refuse gastro-enterostomy to a case of cancer of the stomach because it only prolongs life a year, but does not cure.

DR WOOLSEY said he wished to emphasize what Dr Coley stated in his paper regarding the harmfulness of using the X-rays prior to operation when the case was operable. The speaker recalled two cases of cancer of the tongue where valuable time was lost by giving the X-rays a trial when an operation should



have been resorted to without delay His own experience with the X-rays in cancer had been unsatisfactory

DR COLEY, in closing, said he had not tried to prove in his paper that there was no value in the X-rays, but rather to combat the view that we had in the X-rays a cure for deep-seated cancer Experience had shown that the use of the rays should be limited to the inoperable cases or to superficial epithelioma, and should never be used in deep-seated, primary carcinoma or sarcoma

# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting, May 1, 1905*

The President, HENRY R WHARTON, M D , in the Chair

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### ACUTE GANGRENOUS APPENDICITIS IN TYPHOID FEVER SIMULATING PERFORATION

DR JOHN H JOPSON reported an instance of this complication, with remarks upon the condition

DR RICHARD H HARTE said every one recognizes the gravity of typhoid fever and also of appendicitis, when they occur together, the combination is most serious. At times it is impossible to differentiate between appendicitis and typhoid perforation. If the case is seen early and the course of the disease traced, then one may usually tell the difference, and also be able to operate early, this, however, the surgeon rarely has the chance to do. Symptoms in typhoid perforation are usually more marked, coming on with flash-like rapidity, while appendicitis is commonly more insidious. Both demand immediate operation. Concerning rules for waiting in these cases as quoted and endorsed by Dr Jopson, Dr Harte is not in accord. Waiting is a rather dangerous procedure. Marked irritation in the right iliac fossa developing during typhoid fever is often attributed to appendicitis, and the physician waits in the hope that these symptoms will subside. But if, instead of appendicitis, typhoid perforation has occurred, the abdomen should be opened immediately, every fifteen minutes means the loss of chances for saving the patient's life. Dr Harte has noted that, in cases operated on immediately after perforation, the recovery rate is much greater than when intervention is deferred. For this reason a

waiting policy possesses elements of danger. If appendicitis be actually present, the uncertainty is still greater. Hence, if during typhoid fever the diagnosis of appendicitis is made and the symptoms of perforation develop, the abdomen should be opened as soon as possible. Unless he misunderstood Dr Jopson's quotation of Kelly's statements regarding the frequency of appendicitis in typhoid fever, Dr Harte does not find them supported by his experience. He has operated in quite a large number of cases of typhoid fever, and does not consider appendicitis so frequent as some writers would lead one to believe. The surgeon cannot say absolutely that appendicitis is present during typhoid fever unless he operates. Dr Harte has found very few instances of appendicitis among the cases of typhoid for which he has operated, although he and his colleagues at the Pennsylvania Hospital have operated for this condition during the course of typhoid. In thus speaking about operation, it is recognized that every operator knows the gravity of opening the abdomen of a typhoid patient, and desires to avoid it if possible. All the existing conditions are such as to render operation a very grave procedure. In twenty-six abdominal sections for typhoid perforation, Dr Harte has made the error of operating in two cases when perforation was not present, fortunately, both patients recovered.

DR JOHN H. GIBBON said that he had operated upon two cases of appendicitis during typhoid fever. In one case it could not be demonstrated that the condition was the result of typhoid ulceration of the appendix. In the other, however, there were three distinct typhoid ulcers of the appendix, one being at the base and completely occluding the lumen of the organ. It is thought that in this latter case there might have been no cause for operation had there been no obstruction of the appendix. The first case was operated upon for one of perforation, but in the second case it was not thought that a perforation was present, but the symptoms were sufficiently marked to warrant the opening of the abdomen. In the case reported by Dr Jopson, a noticeable fact is that, although the temperature dropped, the pulse fell from 144 to 128, which does not usually take place in a perforation of the intestine. Dr Gibbon believes that a differential diagnosis of appendicitis during typhoid fever and perforation of the bowel is extremely difficult, yet in the former

condition the symptoms are never so sudden and severe as in the latter

DR W JOSEPH HEARN endorsed the statements of Dr Harte regarding the need for early operation. If the general symptoms usually accompanying perforation are marked, whether they are due to typhoid perforation or gangrenous appendicitis, the sooner operation is performed the better it is for the patient. Dr Hearn usually gives intravenous infusion of saline solution and then at once operates. In a proportion of cases this is successful, though he has also lost many cases. Operation will be successful if performed in time. The rule to be followed is not to wait.

DR JOPSON, in closing, said the figures relating to involvement of the appendix during typhoid fever needed explanation. In 119 cases of typhoid reported from Boston and Baltimore, there was macroscopic evidence of involvement of the appendix in 19. The other statement that one-third of the cases was involved referred to the microscopic picture afforded by the appendix. As to the diagnosis of appendicitis from perforation, many cases of appendicitis come on early in the course of typhoid when irritation in the right iliac fossa is greater than can be attributed to the latter disease. Operation is then safest and intestinal perforation can be excluded because of the early stage of typhoid. Waiting at this time is also more justifiable than at any other. At this stage most mistakes in diagnosis are made. Differential diagnosis in cases such as the one reported is not necessary, even though desirable. There is no way of distinguishing the two conditions except by the preceding history, and even that is liable to lead to mistake as in this case, where symptoms of appendicitis came on as rapidly as they do in perforation during typhoid fever, gangrene and rupture seemed to be almost simultaneous with the pain. The age of the child and the generally bad condition of the intestine doubtless favored gangrene.

#### FRACTURE OF THE HEAD OF THE TIBIA

DR HENRY R WHARTON reported the case of a man, aged fifty-five years, who was admitted to the Presbyterian Hospital, June 24, 1902, having fallen from a bicycle and injured his left knee. When seen by the reporter, a few hours after his admission, the left knee and upper portion of the leg were swollen

and painful. An examination revealed a fracture involving the outer portion of the head of the tibia. There was marked effusion into the knee-joint and adjacent bursæ. The patient suffered great pain, which seemed entirely out of proportion to the extent of the injury, and was probably due to the associated synovitis. He stated that when he fell from his bicycle he landed upon the left foot, and his body was rotated, when he felt something give way in the region of the knee. An X-ray examination showed that there was a separation of the triangular piece of the outer portion of the head of the tibia, with upward and outward displacement of the fragment, necessarily involving the knee-joint.

The limb was placed in a long fracture-box and the region of the fracture was treated by the application of lint saturated with lead-water and laudanum, and after a few days, when the swelling to a certain extent had subsided, a plaster-of-Paris dressing was applied. This dressing was used for six weeks, and after this time the patient began to use his crutches, and at the end of ten weeks was able to walk with the aid of a cane. He had at first very limited motion of the knee-joint, but this improved with use, and finally he regained good use of the limb.

An examination of this case eighteen months after the injury showed that he walked well, but still had some impairment of joint motion at the knee. Extension was perfect, but he could not flex the knee beyond a right angle.

A second case was as follows. A baggage-master, in throwing a bundle of papers from his car while the train was upon a curve in rapid motion, was thrown from the car, striking upon both feet, receiving injuries of both legs which prevented him from rising from the ground. He was admitted to the Presbyterian Hospital, May 29, 1904, several days after the accident. An examination showed that the right leg and knee were greatly swollen, there was also marked swelling in the region of the left ankle. A fracture was located at the outer portion of the head of the right tibia. There was also marked effusion into the right knee-joint and adjacent bursæ. Great pain was complained of in the region of the knee, which was much increased by pressure and attempts to move the joint. An X-ray examination showed fracture of the outer portion of the head of the

tibia, involving the joint, no injury of the bones could be discovered at the left ankle

This patient was treated by a plaster-of-Paris bandage extending from the toes to the upper portion of the thigh. The patient left the hospital at the end of a month, still wearing the plaster-of-Paris dressing.

An examination of this case nine months after the accident showed firm union in the fracture, but still some impairment of the joint motion in flexion. The patient, however, has a useful limb.

A third case of the same injury was as follows. A man, aged forty years, was admitted to the Presbyterian Hospital, February, 1905, having sustained an injury of the left leg in wrestling. He stated that he fell from a step a distance of a few feet and struck upon his left foot, his body twisting as he struck the ground, and he felt something tear in the region of the knee, and fell over helpless.

When seen by Dr. Wharton, a few hours after his admission, he was suffering intense pain in his left limb, which was very much swollen, and the knee-joint and adjacent bursæ were swollen and tense. An examination disclosed crepitus at the head of the tibia, near the knee-joint. An X-ray examination revealed fractures of the external portion of the head of the tibia and of the internal tubercle of the tibia, with involvement of the knee-joint, and upward and outward displacement of the external fragment of the tibia.

The limb was treated in a long fracture-box for a few days, with the application of lead-water and laudanum. For the first few days the pain was so great that morphine had to be freely used to give him any ease. At the end of this time, under anæsthesia, attempts were made by manipulation to press the displaced fragments inward and downward. The limb was then put up in a plaster-of-Paris bandage, including the foot, and extending to the upper portion of the thigh. The patient was more comfortable with this dressing, but suffered at times from severe attacks of pain, which he said came on suddenly, the pain radiating from the knee, up the thigh, and downward to the leg. These attacks were so severe at times that morphine was required.

At the end of seven weeks he was allowed to get up on

crutches, but after being up for a day he noticed that the foot became hot, and presented a superficial, burning sensation. On inspection it was found that the toes on the dorsum of the foot were markedly discolored, and were hot and painful to the touch. Upon removing the plaster-of-Paris bandage, it was found that the redness extended well up upon the dorsum of the foot, and to some extent involved the skin over the ankle, the plantar surface of the foot being neither painful nor discolored, and there was no swelling of the foot. There was no paralysis, the patient being able to flex and extend the foot. He also suffered from severe attacks of pain in the region of the fracture, which passed from the patella to the inner portion of the thigh and also the leg and foot. These paroxysmal attacks of pain were so severe that no relief could be obtained until morphine was given hypodermically.

From the distribution of the pain and the location of the trophic disturbances, it was thought that the external popliteal nerve was probably caught by the displaced fragment, or was pressed upon by callus, and after consultation with Dr. Willard, it was decided to expose the nerve for the relief of this condition. The patient was anæsthetized, and upon examination of the joint it was found that the knee could be flexed to a little more than a right angle. The nerve was then exposed by an incision, and the trunk laid bare for about three inches. It was found that it was not pressed upon by the fragment nor pinched by callus. The upper half of the exposed nerve was normal in appearance, the lower half, to a point where it passes over the peronæus longus muscle, was enlarged and of a deeper color, and the sheath was thickened and contained some reddish serum. The sheath was opened and the nerve was thoroughly stretched. The wound was closed and dressed, and the limb was placed in a posterior binder's-board gutter.

The pain after the operation was very slight, one dose of morphine only being required. The discoloration of the foot and ankle has gradually diminished, and at the time of the report, more than two weeks after the operation, the foot has resumed its natural color.

Dr. Wharton remarked that fractures of the head of the tibia involving the articular surface present several points of interest. First, as regards the mechanism of these fractures. As

far as he could learn, they usually result from a fall upon the foot, in which there is a rotation of the body, with twisting of the knee. Another point of interest is the extreme pain accompanying these fractures, probably due, in fractures involving the external tubercle, to injury of the external popliteal nerve and the rapid effusion which occurs into the knee-joint and adjacent bursæ. The pain and trophic disturbances may occur immediately upon the reception of the injury from injury of the nerve at the time, or may follow later from pressure upon the nerve by a displacement of the fragment, or by callus. In the last case reported, it is interesting to note that the trophic disturbance seemed to be confined to the distribution of the musculocutaneous nerve rather than to that of the anterior tibial nerve, as there was at no time paralysis resulting in foot-drop. Stimson states that fractures of the head of the tibia are slow in repair, and quotes seven cases recorded by Poncet in which the average time of union was about four months.

Restoration of function after these fractures is seldom complete, the occurrence of synovitis and arthritis, with backward displacement of the fragment, interfering with the normal joint motions of the knee. Extension is usually normal, but there is generally more or less interference with complete flexion of the joint. Repair is probably much less prompt than in fractures involving other portions of the tibia.

DR JOHN H JOPSON briefly described a case now under his care which corresponds very closely to those reported by Dr Wharton. The patient is a railroad man, who, while superintending the shifting of cars in the dark, stepped out of a door, six feet from the ground, in the direction the train was moving. He lighted on his feet on loose ballast, and one leg immediately went from under him, there was severe pain in the knee and inability to rise. The mechanism evidently consisted in turning and twisting the leg at the time it struck the ground with considerable force. There was effusion of blood into the joint and underneath the bursa of the quadriceps. When seen several hours later, the patient still complained of severe pain, and there was tenderness over the knee, especially on the outer side. Crepitation could not be elicited, and there was neither shortening nor irregularity. The condition was thought to be laceration of the lateral ligament, but a week later the X-ray showed



a small oblique fracture of the outer part of the head of the tibia running down from the joint, and thus splitting off a fragment of the bone. Pain in the knee persisted for three or four weeks until a final immobilization with plaster-of-Paris dressing. Now, at the end of six weeks, there is no pain, and the patient appears to be doing well, the final result cannot of course be predicted.

#### SUTURE OF THE FEMORAL ARTERY

DR EDWARD MARTIN reported the case of a man, twenty-three years old, who was admitted to the University Hospital, May 18, with a history of having been wounded the day before by a piece of steel chipped off from a side set by the blow of a ten-pound hammer. There was an immediate profuse bleeding, the blood spurting to a distance of two inches. This was controlled by means of a tourniquet. There was found a wound about half an inch in length at the junction of the middle and lower third of the left thigh directly over the course of the femoral artery. On the removal of the tourniquet there was no further bleeding, the wound was thoroughly cleansed and a sterile pad was held in place by means of a tight bandage. During the night there was a moderate degree of oozing, and examination the following day showed a tumor about the size of a man's fist, fusiform in shape, giving an expansile pulsation and a harsh bruit. Popliteal and tibial pulsations were absent. A tourniquet was applied at the level of the perineum and a 17-centimetre incision was made with its centre of the wound of entrance. On opening the deep fascia a large thrombus was found, to the outer side of which lay a small jagged piece of steel. There was in the anterior surface of the femoral artery a ragged wound 2 centimetres in length opening into the lumen of the vessel. The artery was freed above and below and a loop of large gut was thrown about it in each position. The tourniquet was then removed, bleeding being controlled by traction upon the loops, which also rendered the vessel more accessible to suture. Fine curve-faced needle and No. 0 chromicized gut and No. 8 silk were employed for the sutures, five of which were applied. On relieving tension, there was a spurt of blood at the most ragged part of the wound, requiring the insertion of a sixth suture. On removal of the traction ligatures the artery pulsated below. The

fascia was sewn above it with chromicized gut sutures Drainage was inserted, since it was quite certain that the wound had been infected by the foreign body The external wound was closed The patient made an uninterrupted convalescence, pulsation being detected in the popliteal artery on the following day, and remaining thereafter

Dr Martin said that the interest attaching to cases such as this is incident to the fact that the opportunity of suturing a large artery rarely occurs in the course of surgical practice, since such wounds when accidentally inflicted are in themselves unusual, and when they do occur are likely to be attended by bleeding so profuse as to be fatal before aid can be rendered

Although medical literature contains a number of instances of attempts at sewing both arteries and veins, Murphy was the first to thoroughly popularize the method by a series of brilliant experiments, and, finally, by a clinical experience which still remains the most striking practical demonstration of the practical utility of the method The common femoral artery had been almost completely severed by a bullet This vessel was resected, and the proximal end was invaginated into the distal for a distance of one-third of an inch by means of four double-threaded needles which penetrated all the coats of the artery A row of sutures was then placed around the distal end, penetrating only the media of the proximal portion, after which the adventitia was drawn over the line of union and sutured A wound of the vein inflicted at the same time was also sutured Convalescence was uninterrupted, the patient making a complete recovery

In the experimental work on this subject, there has been more or less insistence upon the need of avoiding the intima in the placing of sutures This, however, seems to have no bearing upon the formation of clot, which is always possible, and which, perhaps, in the majority of cases may be expected, though Dörfler, in a collection of forty-three experimental cases in which the intima was included in the suture, noticed that there was thrombosis in but five

Brewer, in attempting to close a wound in the femoral artery, noted that the sutures tore out, and was led to a suggestion which has been attended with considerable success, namely, the application of rubber adhesive plaster about the vessel, the outer wall of which is previously dried by swabbing with ether

Experimentally, this method served admirably, though it is noteworthy that *thrombosis* occurred at times

In the application of sutures to a wounded artery, the needles should be round, pointed ones, and of such diameter that the thread which they carry fills the holes made by them. The immediate bleeding of the suture points is overcome by the use of catgut, though silk is the suture material of choice. No effort should be made to avoid the intima, though the inclusion of this coat in the suture does not add materially to the strength of the union. In attempting to prevent the entrance of the needle into the lumen of an artery, there is danger that the tough media may not be included, and thus the line of union may almost immediately tear out from the effect of blood-pressure. For a partial cut or tear the continuous suture is preferable.

The likelihood of thrombosis is in direct proportion to the amount of damage done to the intima, hence the artery should be handled gently, and the least possible mechanical interference compatible with its proper stripping and exposure, and the application of the suture should be the rule. Infection is almost certainly followed by thrombus, and of course exposes the patient to the danger of secondary hæmorrhage. Of this, however, there is now little fear. The line of suture should be reinforced by stitching the adventitia closely about the artery, and moreover additional support should be given by a suture of the overlying soft parts.

For end-to-end closure the invagination method of Murphy has proven successful. Its application is also easy.

Perhaps the most surprising feature of these artery sutures is the fact that there has been no case of aneurism yet reported, though more than two dozen clinical cases are on record. There are comparatively few positions in which such a procedure as suture of an artery is absolutely essential. In all the smaller vessels complete ligation would be the method of choice. When the carotid artery is wounded, its ligation is so often followed by secondary cerebral degeneration that an attempt at suture is clearly indicated. The common femoral is also a vessel which should be sutured, though even in this case, providing the vein remains intact, the danger of gangrene is comparatively slight. The abdominal aorta is essentially a vessel fitted for suture in case of wound. Theoretically, at least, a suture or invagination

of the renal artery, or of the superior mesenteric, may at times be feasible, or in the latter case even the implantation of the divided end of the vessel into the aorta. The possibility of closing a wound of the artery also suggests for consideration the desirability of opening these vessels in cases of threatened embolic gangrene.

DR FRANCIS T STEWART reported the case of a man, aged thirty years, who was struck on the inner side of the right thigh by a small piece of steel, which penetrated the tissues, leaving a slit-like opening in the skin about one-fourth of an inch long. When admitted to the Germantown Hospital shortly afterwards, there was still considerable bleeding, although a tight bandage had been wound around the limb. When Dr Stewart saw the patient the following day there was no bleeding and no swelling of the thigh. Several X-ray pictures failed to locate the piece of steel. Eight days after the accident, during the night, the patient was awakened by severe pain in the region of the wound. The thigh rapidly swelled, and pulsation soon became evident both to the eye and to the hand. There was no external bleeding, no thrill, and no bruit. Pulsation could be felt in the anterior and posterior tibial arteries. Twelve hours later a long skin incision was made along the course of the femoral vessels. The upper end of this incision was deepened until the femoral artery could be compressed between the fingers of an assistant. The artery was then traced downward to the middle of Hunter's canal, where a ragged opening about one-eighth of an inch in diameter was found. The artery was then grasped distal to the wound by the second hand of the assistant, and the wound was closed by a continuous silk suture penetrating all the coats of the vessel, an intestinal needle being employed. A second continuous suture of silk involving the sheath of the vessel was applied for a reinforcement. No leakage being detected after the removal of compression, the muscles were sutured with catgut and the skin closed with silkworm gut, drainage being omitted, although the tissues were extensively infiltrated with blood. The leg was maintained in an elevated position for two weeks. The wound healed without infection. The anterior and posterior tibials pulsated with undiminished force from the time of the operation until the patient left the hospital.

Dr Stewart added that it was interesting to note that in

1759 Hollowell successfully closed a wound in a brachial artery following venesection by passing a needle through the lips of the wound and tying a silk ligature beneath the needle. In 1762, Lembert proposed arterial suture and experimented on the horse. Following this, however, repeated experiments on animals seem to demonstrate that uncontrollable bleeding from the stitch-holes would occur, that a thrombus would form at the point of suture, or that sepsis and secondary hæmorrhage would follow. It was also feared that an aneurism might develop at the line of suture, or that a clot embolus might be washed into the circulation. In 1889, Jassinowsky showed by a large number of experiments on dogs and calves that these accidents were not to be feared. Most operators have followed his plan of operation, which is as follows. Control of the circulation. Isolate artery and push the sheath back. Suture the media and adventitia with interrupted sutures of fine silk. Take off the clamps with simultaneous compression of the vessel wound. Sew the sheath, then the fascia, then the skin. The continuous suture is believed to be preferable because of its rapidity, and because there is no tendency towards leakage between the points of insertion, and that a suture involving all the coats of the artery is preferable, because it is easier to apply and much more sure to hold. Hubbard (*Boston Medical and Surgical Journal*, vol. xlv, 1902), in an article in which he collects twenty cases of arterial suture, states that in five cases a suture involving all the coats was successfully employed, and quotes Dorfler, who demonstrated experimentally that a suture passing through the intima would neither cause bleeding nor thrombosis.

DR RICHARD H HARTE advised trial of suture in case of wound of the femoral or of any other large artery, if this fails, ligation can later be performed. He had seen a hospital resident wound the iliac artery with a Hagedorn needle while assisting at an operation for hernia. Hæmorrhage was profuse, the blood spurting a distance of eighteen inches. Dr Harte exposed the vessel at once and sutured it with silk. The man did well, the case, of course, being much more favorable than was that of Dr Martin's. Some weeks later the man died from another condition, and inspection of the wound showed that repair of the vessel was perfectly satisfactory. Hence he would not hesitate to suture a vessel, as he believes this to be good surgery. The

opportunity seldom presents, but when it does, it should be met by suturing

DR DE FOREST WILLARD said that Dr Brewer's work upon the suture of arteries is a most valuable contribution. Although wrapping the vessel with rubber tissue introduces into the body a foreign element, yet Brewer's reports are very satisfactory. Dr Dorrance, of the University of Pennsylvania, is now conducting experiments for Dr Willard, employing, instead of rubber tissue, flaps of fascia to enclose and support the wounded vessel. It is yet too early to draw conclusions, but present indications are that this method will prove of value. By this means it may be possible to succeed in closing vessels whose walls are not strong enough to hold the sutures or the edges of which are too ragged to approximate. The fascia is, of course, left with a base of attachment to preserve its vitality.

DR MARTIN, in closing, emphasized the facts that a growing clinical experience has failed to demonstrate a single case of aneurism following suture of the large arteries. The absence of secondary hæmorrhage and diffuse traumatic aneurism is equally astonishing. It still remains to be proven that in the human either partial or complete wounds can be sewn with an absolute assurance against thrombus, and it is doubtless true that in many of the successful cases reported thrombi formed. However, the possibility of opening even the largest vessels, such as the aorta, and closing them again with safety, suggests a variety of forms of intra-arterial surgical interference, particularly in the direction of preventing gangrene in cases of embolic plugging. Indeed, this has been once attempted because of threatened gangrene of the leg. It is conceivable that an extraordinarily pre-scient surgeon might thus relieve one suffering from the early stages of mesenteric embolus.

#### A NEW METHOD FOR IMMEDIATE ENTEROSTOMY

DR FRANCIS T STEWART said that in cases of enterostomy in which immediate opening of the intestine is mandatory, there is considerable risk of infection of the peritoneal cavity by fæcal contamination. The packing of gauze around the loop about to be opened sometimes averts this danger. Careful suturing of the bowel is an expedient which may succeed, but in cases in which the intestinal wall is stretched and thinned by marked dis-

tention it is practically impossible to insert a needle in the bowel wall without entering the lumen and causing leakage Up to the present time the Paul's tube or one of its modifications has been the best means for safely draining the intestine in these cases During the past winter he had employed the following method in three cases, two of which died shortly after operation After opening the abdomen, the desired loop of bowel is drawn into the wound and emptied of its contents by a gentle milking process A clamp is then placed at either extremity of the loop to prevent the reflux of fæces into it, and the whole is surrounded by gauze packing One-half of a Murphy button is inserted into the empty loop of the intestine through a small incision, and the other half is squeezed into the end of a long rubber tube whose caliber is slightly smaller than that of the flange of the button, thus making a tight joint The two halves of the button are then pressed together, or, in other words, a lateral implantation is made between the rubber tube and the bowel The clamps are now removed and the fæces allowed to drain through the rubber tube into a receptacle on the floor Whether a bar has previously been placed beneath the bowel or not, the intestine should be securely fastened to the margins of the wound by sutures in order to prevent the prolapse of any additional coils of intestine, with a collapsed bowel, the sutures may be introduced without fear of leakage By this method an absolutely air-tight joint is made between the bowel and the rubber tube, so that the intestine is drained without the slightest possibility of infection of the peritoneal cavity By the time the button has sloughed through the bowel (at the end of the third day in his surviving case), adhesions will have effectually closed the peritoneal cavity The dressing need not be distended until the button comes loose

#### VOLVULUS OF THE OMENTUM

DR FRANCIS T STEWART said that in a paper read before the College of Physicians, November, 1903, he reported a case of torsion of the omentum, and appended an abstract of eight other cases Since then, Rudolph (*Wiener klin Rundschau*, 1903, Nos 44-47) has collected twenty-nine cases, of which twenty-three were intra-abdominal He states that in one case only was the exact diagnosis made before operation Sonnenburg (*Arch Internat de Chirurgie*, vol 1, fasc 1), Noble (*American Jour-*

*nal of Obstetrics*, 1904, vol xlix), and Scudder (*ANNALS OF SURGERY*, December, 1904), have also reported cases. These, together with the present case, make thirty-three thus far reported. A hernia was found in all cases except five. He now was able to report a second case. The patient was a policeman, aged thirty-four years, and weighing 250 pounds, who entered Professor Keen's service in the Jefferson Hospital, April 8, 1905. Up until three years ago he was in the best of health, every few months since that time he would experience a sharp attack of indigestion, with severe pain in the abdomen. For the past fifteen years he has had a reducible inguinal hernia about the size of a lemon on the right side, which has never bothered him, and for which he has never worn a truss. Just after breakfast, the day preceding admission to the hospital, he felt one of his attacks approaching, the pain, however, being more severe than usual. On admission to the hospital there was severe abdominal pain, especially on the right side. The greatest point of tenderness was just below and to the right of the umbilicus, rigidity of the abdominal muscles was general, but especially marked on the right side. Owing to the thickness of the belly-wall and to the rigidity of the muscles, no mass could be felt, although the right side seemed to be slightly more prominent than the left. The hernial sac was empty. The temperature was 98.5° F, pulse, 90, respirations, 20, there had been no vomiting, the bowels had moved the previous day. A diagnosis of acute appendicitis was made and the abdomen opened thirty hours after the onset of pain. After some difficulty, the appendix was found between the layers of the mesocolon and excised. It measured six inches in length and, except for several ecchymotic spots in the mucous membrane, was normal. A further search of the abdomen brought to light a mass of omentum, dark red in color, much harder than normal, and evidently in the first stage of gangrene. On pulling the omentum from the abdominal cavity, a twist consisting of three complete turns from the patient's right to left was found just below the transverse colon. After amputation, the spread-out mass measured twelve inches longitudinally and fifteen inches transversely, and weighed one and one-half pounds. At its free edge the omentum presented five large pockets, due to a folding over of the edge with subsequent adhesions. The abdomen was closed without drainage, and the patient made an uninterrupted recovery.



# TRANSACTIONS

OF THE

## CHICAGO SURGICAL SOCIETY

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*Stated Meeting, April 3, 1905*

The President, DR L L McARTHUR, in the Chair

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### CARCINOMA OF THE LIVER

DR L L McARTHUR showed a patient that had been exhibited to the Society on former three years. The first time was during the Presidency of the late Dr Christian Fenger. The patient had been referred to him by Dr Favill, with symptoms of ulcer of the stomach. There was difficulty attending the differentiation between ulcer of the stomach and malignant disease of that organ. After long-continued lavage, etc., the patient was transferred from the medical to the surgical ward of St Luke's Hospital to the speaker's service, and operative intervention resorted to. The operation disclosed a tumor of the lesser curvature of the stomach, which had grown into the under surface of the left lobe of the liver, requiring excision of a wedge-shaped piece of the liver and a wedge-shaped piece of the lesser curvature of the stomach. Specimens were examined by the pathologists, Drs Hektoen and Zeit, and the disease was pronounced adenocarcinoma. When the speaker presented the microscopic specimens to the Society three years ago, Dr Fenger, on examining them, pronounced the disease indubitable carcinoma of the stomach invading the liver, without any limiting membrane whatever, therefore not an adenocarcinoma, as the latter always pushed the capsule before it. The diagnosis was then revised by Drs Hektoen and Zeit as a carcinoma proper of the liver.

The patient was presented again for the fourth time, not because he was still alive (death had been predicted to take place in a short time), but because in the past year symptoms of ulcer

of the stomach had again recurred and patient was again referred to him. On making an exploratory section he found that there was no recurrence of the disease at the seat of the old scar, that there were no new growths to be detected in the liver nor in the stomach wall, so he made a gastro-enterostomy by the anterior method, but perforating the gastro-colic omentum and carrying the knuckle of bowel posteriorly to the stomach, in front of the colon. The man had again been relieved of the symptoms of ulcer, and had gained thirty pounds in weight. Patient was an orderly at the hospital, and was again on duty attending to his work.

#### LYMPHATIC AND HEPATIC INFECTIONS SECONDARY TO APPENDICITIS

DR JOHN C MUNRO, of Boston, Mass., read a paper with the above title.

DR JOHN B MURPHY said that his experience had been very small so far as infections from the appendix in association with the portal vein are concerned. If we take the type of various infections as a standard, we conclude by comparison that infections from the lymphatics take place rapidly, that infections through the portal circulation to the liver take place slowly, as infections through the lymphatics take place rapidly after the primary infection, that is, before there is a local immunity through occlusion of the lymphatics by the infiltration, which, however, does not always occur. The most striking example of absence of local infiltration (immunity) he ever saw was recently in a case he observed at Elgin, Illinois, with a history resembling perforative peritonitis that began on Friday, two days previous to operation. The symptoms immediately following intense pain were vomiting, cyanosis, great cardiac depression, which continued from the time of onset of the pain until two hours before operation. There was no sensitiveness in the area of the appendix, there was sensitiveness in front of the tip of the right costal cartilage extending downward. The question arose in his mind, Why should this patient be collapsed, why cyanotic, as he was a young, vigorous man, and why should vomiting persist in a case of ordinary appendicitis? His diagnosis was fat necrosis. The diagnosis advanced by the attending physician, Dr Whitman, was appendicitis. The leucocyte count showed 29,000, which con-

traumatised fat necrosis, and this caused the speaker to waver in the diagnosis. Upon opening the abdomen he found gangrene of the appendix, no perforation, and no peritonitis, and *not the slightest infiltration of the meso-appendix*, the first time he had ever seen this, notwithstanding the fact that it was forty hours after the onset of the infection. Why was there an absence of infiltration in the meso-appendix? Infiltration means local immunity, local resistance to the absorption of infective products. Here there was no local immunity. Here were all the symptoms of intense sepræmia, and they corresponded exactly with the pathologic findings, because there was no local resistance offered by the lymphatics, which accounted for the intensity of the collapses from the infection. On examining the upper part of the abdomen, there were no evidences of involvement of the pancreas or liver, there was no local obstruction to the lymphatic flow. When pus infections are transmitted to the liver through the portal circulation, we must have a secondary process before we can have hepatic infection, we must have thrombophlebitis and escape of the infective material into the liver.

He had had two cases of pyelephlebitis, in which the diagnosis had been made and verified by postmortem—one following operation for appendicitis and the other following an operation for hemorrhoids. Ten days after the hemorrhoidal operation, the patient had chills and fever, which were characteristic, namely, chills, with sudden elevation of temperature, the temperature remaining high for a time, then dropping down to normal. There was no regularity about it. It was typical of hepatic infection, whether that infection was from the lymphatics, from an impacted stone in the cystic or common duct, or from the portal vein. He saw this case in consultation six weeks after the operation for hæmorrhoids. The diagnosis was made on the clinical course of the chills and fever, and not on the physical findings. The necropsy showed the direct tract of infection from the hæmorrhoidal area to the portal vein and the secondary multiple abscess of liver and spleen. The other case occurred in a child within the last year that had been operated for appendicitis. The temperature was normal for forty-two hours after the operation, and then it began to rise. A diagnosis of pyelephlebitis with hepatic infection was made, and post-mortem examination verified it.

The question of how the lymph circulation carried infection

into the substance of the liver was interesting, and some light has been thrown on this recently by the work of Terrier and Cunéo on the lymphatics. These authors have demonstrated beyond question that in certain areas of the liver, and particularly on the lower and costal surfaces of the right lobe, we have lymphatics, not taking the usual general course from the surface of the liver beneath Glisson's capsule, extending to the suspensory ligament, or extending to the sublymphatic glands around the gall-bladder, but passing directly from the surface into the liver and along the portal vein to the hilum. If these lymphatics take this course, as there is every reason to believe they do, one can readily see how an infection extending to the under surface of the liver from the appendix, either by direct lymphatic transmission or along the surface or side of the colon, could immediately infect the lobe of the liver and form an abscess. This is the most elucidating information which he has received up to the present time. He had seen on one occasion the appendix with a peri-appendiceal abscess adherent to and involving the under surface of the liver, but not extending into the parenchyma.

DR E WYLLYS ANDREWS recalled the paper read about a year ago by Dr Le Conte, on the subject of rupture of the mesenteric glands simulating typhoid perforation. This belonged to the category of atypical cases, the source of the infection being a typhoid ulcer, producing lymphadenitis and suppuration in the gland, with rupture of the abscess into the peritoneal cavity, which simulated closely perforative typhoid, causing subdiaphragmatic abscess, violent infection, and collapse. Since reading this paper, two cases had occurred here, one in the speaker's own practice, and one in the practice of a colleague. The abdomen was opened under the suspicion that he had a perforating typhoid, and the true condition was that of a retroperitoneal abscess bursting through into the peritoneal cavity. He thought it was impossible to make a differential diagnosis between this condition and typhoid perforation before operation.

Two cases of pneumococcus peritonitis also occurred, one in the County Hospital and one at Reese Hospital. Both were marked by an absence of distention, ileus, or the ordinary signs of diffuse peritonitis. Both ended fatally.

DR L L McARTHUR reported the following cases in his own experience. First, as a type of hepatic infections probably portal

in their origin was a case referred to him by Dr Collins of this city, seen by Dr Collins first at about ten o'clock at night, diagnosed as an acute gangrenous appendicitis, and operated by him and the speaker at about five in the morning, a gangrenous appendix being found and removed, as yet unruptured, but in a condition so that migration of the organisms was possible through the dead and gangrenous wall of the appendix. However, it was deemed safe to close the abdomen with a small drain in case there had been a passage of micro-organisms through the intact but dead wall of the appendix. There was a normal, satisfactory convalescence, the patient being up on the tenth day, when symptoms of a low grade of fever, without any local symptoms, developed. Two consultants were inclined to regard it as an atypical typhoid, because a Widal was reported from the Health Department, and a partial Widal at the hospital examination. The temperature rose higher and higher for three or four days, until it reached 106° F, with violent rigor. In a state of desperation, in the absence of any local guide, the speaker inserted a Dieulafoy aspirating needle of good size into the right lobe of the liver, and fortunately struck a cavity containing stinking pus. The trocar was left *in situ*, and the patient taken to the operating table. After aspirating a sufficient quantity of pus to reduce the abscess pressure, the liver was exposed along the track at which the needle had entered (between the tenth and eleventh rib on the right side), finally exposing the abscess, which was opened and drained, the patient making a good and prompt recovery. The temperature dropped, and all symptoms became normal in a brief time, with this exception, there was a persistence for six months afterwards of a biliary fistula, evidently a large bile tract having been cut off by the large abscess. As long as the tube was left *in situ* the patient was well, up and around, and gained in weight. Once or twice the removal of this tube was attempted, but each time a rise of temperature required its reinsertion. The patient drifted away from the hospital. He returned after three months, with a suspected retention in the old abscess. Operation was made, but no abscess was to be found. The abdomen was opened, the gall-bladder region and subhepatic region explored, the liver explored by multiple puncture, but no abscess found. Death ensued nine months after the appendectomy, which, by the way, made no further trouble, and at the post-mortem examination it was found that a small abscess not

much larger than an almond had formed apparently in the lymphatic gland behind the common duct and internal to the usual position of these lymphatic glands at the hilus of the liver

He thought it uncertain whether in this case the infection came from the hepatic area along the venous channel, and whether death finally ensued from this solitary abscess in the lymph-gland at the hilus of the liver, or whether a secondary infection from the liver to this lymphatic gland had occurred

One of the most striking types of infection of the portal circulation was seen by him in a case in connection with Dr Billings and Dr Bridge, in which the diagnosis was doubtful Dr Bridge had had the patient under treatment for eleven days as a case of atypical typhoid Dr Billings was called in to see the case, and considered it one of interstitial hepatitis, probably a pyelephlebitis There was a sudden exacerbation of an alarming character in the symptoms of the patient, much resembling a typhoid hæmorrhage, with great shock, collapse, cold, flammery extremities, depleted blood-vessels Dr McArthur being called, was inclined to believe it to be a case of perforation from typhoid associated with typhoid hæmorrhage The condition of the patient being desperate, a laparotomy was made Perforation of a large vein in the mesentery of the cæcum was found, induced by a gangrenous appendix resting upon it There was gangrene of the wall of that mesenteric vein and a severe hæmorrhage into the abdomen of a portal type Post-mortem examination revealed a pyelephlebitis which had occurred prior to the giving way of this wall, and the diagnosis of Dr Billings was verified to that extent

Again, in the practice of Dr Frankenthal, the speaker saw a case of sudden fatal hæmorrhage as a result of a phlebitis incident to the resting of the appendix upon such a vein Hæmorrhage was so severe as to cause death and occurred through the abdominal wound, which was provided with a gauze drain, the blood escaping externally, but was so severe that before aid was given death ensued

DR MUNRO, in closing the discussion, said he had operated altogether on thirty-seven cases out of thirty-nine, but this did not include several cases he had seen in other men's work There had been quite a number of such cases as he had described in his neighborhood He recalled the case of a patient, ill for a number

of months, where a wrong diagnosis had been made, although it was a perfectly clear and straight case from the start of a typical appendicitis, with portal infection. It should have been recognized as such, but was not, and, what was most significant, at the autopsy the appendix was overlooked and not examined.

As to the infection that took place rapidly, both lymphatic and portal, the course might be extremely rapid, and simulating cases of fat necrosis at times. In one of his cases the lymphatic and portal infections were overwhelming, so that it was impossible to tell which was the more rapid. He believed that, in the long run, portal infections took place more rapidly than lymphatic, but not necessarily.

It was interesting, in going over the autopsies of cases reported twenty to forty years ago, to see that the three types were more or less grouped together, and, although there might have been cases in which portal infection predominated, yet careful autopsy would show that the lymphatics were often infected as well.

As to Dr McArthur's case of biliary fistula, he had never seen a fistula persist as long as that without the patient dying. He thought his case was probably infected through the lymphatics. One of the speaker's recent cases of this type recovered. He was sure from his observation that lymphatic gland infections would remain dormant for months at a time, and then wake up, so to speak, and prove serious or fatal. Hæmorrhage from the veins he had not seen recorded.

#### EXCISIONS OF LIVER TISSUE

DR JACOB FRANK reported eighteen experiments on dogs. Two consisted of simply incising the liver through its entire thickness, without any suturing or other attempt to control hæmorrhage. Both dogs recovered. In the remaining sixteen experiments he pursued the following plan. When a portion of liver was to be removed in a transverse direction, a wedge-shaped piece was removed transversely to the viscus, leaving the organ with two flaps forming a trough. The flaps were then quickly coapted, and with a long, non-cutting needle, threaded with a medium heavy catgut, a continuous suture was taken, the sutures alternating, one carried through the liver tissue near the bottom

of the trough, and one superficially, until there was complete closure. It required very slight tension to approximate the flaps. The main object was to bring the flaps together obliterating all dead space. When a portion of liver was to be removed in a longitudinal direction to the viscus, a wedge-shaped piece of the entire thickness of the liver was cut out longitudinally, thus removing the desired part. The broad, raw surfaces left by the removal of the wedge-shaped portion was converted into troughs, which was accomplished by the excision of wedge-shaped pieces. The troughs thus formed had two flaps. When the operation was completed, the raw surfaces of the original V left were transformed into smooth, continuous liver tissue, assuming the form of liver borders, and the V space left persisting as a notch.

This method of incising the liver facilitated easy suturing and did not require any tension on the suture to coaptate the flaps. Hæmorrhage was successfully arrested, and the continuity of liver surface re-established. No drainage was used in any of the experiments.

DR JOHN C MUNRO said that the ordinary V-shaped incision had proven sufficient in a number of instances in which he had sutured the liver, using coarse catgut. In bringing the edges of the wound together, it was best to have an assistant make pressure on the liver itself with his hands, bringing the flaps together, before placing the sutures. They could then be tied, without the liability of their cutting through.

DR WILLIAM E SCHROEDER stated that a year and a half ago he removed a third of the right lobe of the liver for primary abscess, and used a long needle with mattress sutures for suturing the liver tissue, with which he was able to control hæmorrhage nicely. The patient made an uninterrupted recovery.

DR L L McARTHUR had had two cases in which he had sutured the liver, one requiring the removal of a wedge-shaped piece of the under surface of the liver. In this case tamponing was quite sufficient to control the hæmorrhage. In the other case the tumor was situated under the ensiform cartilage, the patient was transferred to the surgical service of the hospital as a probable aneurism of the aorta. Bruit and pulsation were present and vomiting distressed the patient. A laparotomy was made. A diagnosis was made of possible tumor of the liver pressing on the stomach and producing vomiting. This was found to be true, and



search for the primary source of the trouble in the stomach or gall-bladder failed to reveal primary carcinoma there. A carcinoma of the left lobe of the liver as large as an orange was removed by means of a wedge-shaped incision. Tamponing was resorted to for controlling hæmorrhage, which it did satisfactorily. The patient recovered, so far as the removal of the tumor was concerned, but died later of carcinoma of the lesser curvature of the stomach, which was so small as to have been overlooked. Where large wedge-shaped pieces are removed from the liver, the speaker thought that patients would fail to have an exit for the bile, and that therefore leakage would occur. The patient mentioned had a permanent biliary fistula, and died from carcinoma of the stomach. To control hæmorrhage in that way, he would expect a biliary fistula, if extensive wedge-shaped pieces of the liver were removed from the human being, with sequelæ later to be dealt with.

DR FRANK, in closing the discussion, said his experience had been that, with a wedge-shaped piece taken out of the liver, it was almost impossible to bring the tissue together. It was certainly impossible to hold with suture the liver tissue long enough for it to unite, and this was one of the reasons that induced him to conduct the series of experiments he had detailed. He had cited cases in which tamponade was employed, as referred to by Dr McArthur, and his experiments were conducted with a view of doing away with tamponing or packing. He thought the surgeon should deal with the liver as he would deal with a case of resection of the kidney or the removal of the uterus, closing the wound completely. In injuries of the liver there was usually bile leakage, which came on six, eight, or nine hours afterwards, and was it not possible, if one could bring the two surfaces in contact, to re-establish continuity? Then union would take place so rapidly that there would be no leakage of bile.

## REVIEWS OF BOOKS.

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THE MODERN MASTOID OPERATION By FREDERICK WHITING,  
A M, M D Royal Square Octavo Philadelphia P  
Blakiston's Son & Co

The author in his preface excludes, as beyond the scope of the present work, the technique of the radical operation for chronic otorrhœa, and the methods of procedure in sinus thrombosis, brain abscess, and other intracranial inflammatory processes, but promises a publication covering this field in the not distant future. He well says that "as a life-saving measure few surgical procedures rival and none surpass in efficiency the modern mastoid operation."

The first portion of the work is historical and is divided into three chapters. The first chapter describes the development of the operation for drilling the mastoid process. The second chapter treats of the operation devised by Schwartz, to whom just credit is given in the following words: "Schwartz executed, and consequently enjoys the undisputed distinction of having clearly enunciated, the technical and symptomatic principles upon which are based the steps of the modern mastoid operation as performed to-day." The author states that Gruening's modification of the Schwartz operation—the removal of the mastoid tip—"was the only essential departure from Schwartz's original steps which twenty years of continuous experience had dictated." The third chapter describes what the author calls "the complete mastoid operation," "because of its intent to remove the entire cellular structure of the mastoid apophysis." The author claims as the first point of difference the method of making the tegumentary incision. The incision pictured, however, is not original, being to all intents the well-known and previously described classical

incision with a horizontal limb at right angles on a level with the centre of the external auditory meatus This incision, which has been in use for some time by various surgeons, exposes to view "the entire mastoid apophysis," "thus insuring a comprehensive view of the operative field" "The second difference, from the Schwartze operation, as modified by Gruening, is the removal of the pneumatic spaces and diploic cells at the posterior root of the zygoma" To the author, himself, the credit for this modification is largely due The author claims that "in every instance where secondary operation has been required in his service the offending agents were found" in this region Purulent accumulations in the posterior root of the zygoma "have in several instances in the writer's experience caused erosions of the inner table, and been responsible for small epidural abscesses of the middle cranial fossa, while cortical perforations of the root of the zygoma, with accompanying subperiosteal abscess, are by no means so infrequent as to excite special interest" "The thorough removal of the zygomatic cells in conjunction with a similar treatment of the mastoid tip has proved in the hands of the writer an unequivocal success, and he earnestly commends the procedure as a method calculated, when conscientiously pursued, to produce a satisfactory result in every instance" this certainly is a strong claim if substantiated by time and experience, and the author has warrant in the latter He regards "the complete mastoid operation as a positive assurance of successful healing and an infallible safeguard against the vexations and annoyances of secondary operation"

Chapter IV is concerned with the pathology of suppurative mastoiditis, and is so well written, so illuminating, and so much to the point, that any attempt to convey an adequate idea of its excellences would do the author an injustice it should be read in the original

The preliminary preparations for operation constitute the subject matter of Chapter V

Chapter VI describes the tegumentary incisions

Chapter VII is concerned with the elevation of the periosteum and the retraction and reflection of the flaps

Chapters VIII, IX, and X describe the various stages of the attack on the bone up to the exposure and clearing out of the antrum. The author gouges out a groove beginning in the suprameatal triangle at the centre of the suprameatal spine and extending thence downward to the tip, keeping the posterior margin of the bony meatus in view and hugging it tightly, this groove is deepened until the cellular structure is reached, when the curette or Volkmann spoon is utilized to undermine the cortical bone. In infants and young children, the curette is used to make the initial groove and the entire opening in the mastoid bone. The bone wound is widened by making grooves parallel to the initial one in the cortex and removing the cellular structures with the curette, further advance being assisted by the use of the rongeur. After the antrum is opened, "the walls enclosing this space should then be removed until no overhanging borders remain" "the opening of the antrum is the step of fundamental importance" The author recommends that the operator "desist from using the chisel, and employ the curette and rongeur at the earliest moment possible"

The removal of the mastoid tip and of the cortex and cells overlying the sigmoid groove are described in Chapters XI and XII

The author, in Chapter XIII, gives his reasons for and describes his method of removing the cells at the posterior root of the zygoma. These cells lie "just in front of and external to the antrum" and "are nearly always occupied in front of and external to the antrum" and "rarely nearly always occupied by necrotic granulations when purulent mastoiditis has existed for any length of time" "The diploic structures in contact with the sigmoid groove and the overlying subcortical cells as far back as the posterior border of the groove should be curetted

until the inner table is smooth" "The rough and irregular margin of the entire opening in the mastoid process should be carefully smoothed with the rongeur and curette" The inflammatory process may be confined in exceptional cases to the region in and about the zygomatic cells "With the removal of this portion of the mastoid, the last structures which are liable to die as the result of purulent mastoiditis disappear" "An operator will be certain of his result only when all cellular structures have been removed" In smoothing the bone surface, "the curette should be held so that the cutting edge lies as nearly as possible horizontal with the surface which it is intended to smooth" "Surfaces which have thus been rendered smooth granulate much more rapidly and evenly and heal more quickly"

The author, in Chapters XIV, XV, and XVI deals with the closure, dressing, and after-care of the wound

Chapter XVII covers the indications for the mastoid operation, with differential diagnosis The author states that "deafness, subjective noises, fulness, and kindred sensations are of no material importance, and are entirely devoid of any significance," the reviewer agrees with Sheppard, who attaches *considerable confirmatory significance* to the presence of persistent, well-marked throbbing tinnitus "Deep boring pain which grows worse at night must always be regarded as decidedly significant" The author rightly draws attention to "a symptom which is not always present, but which, when it exists, is entitled to consideration, decided prostration, or an indisposition for exertion or effort" Bulging of the superior posterior membranous canal wall "may be regarded as the most definite and pronounced of all fundus symptoms of mastoiditis" "The only distinct evidence of mastoiditis" which the tympanic membrane affords is a pronounced bulging "Tenderness of the mastoid bone is justly and universally regarded as the one indication distinctly characteristic of mastoid disease" "but negative testimony is unfortunately by no means conclusive evidence that the pneumatic

structures of the mastoid do not contain pus " The writer urges "that resort should be had to operative measures at the earliest moment when, in the presence of suppuration from the ear, a majority of the symptoms enumerated are to be recognized "

The book is a veritable triumph of the book-maker's art, handsomely bound, beautifully printed on heavy paper, and with most excellent plates The reviewer has not in a long time enjoyed such a treat as in reading this most entertainingly written book But this very excellence in the production of the book as such is also somewhat open to criticism, for it has involved a certain sacrifice in convenience, as the book is thereby made somewhat heavy and unwieldy, and the cost of production has necessitated the imposition of a selling price which must prove quite a tax upon those who will mainly be benefited by the reading of it, *i e* , the beginners in the otological field

HENRY A ALDERTON

INTERNATIONAL CLINICS Edited by A O J KELLY, A M , M D  
Vols I and II, 1905 Philadelphia J B Lippincott Company, 1905

Vol I of these excellent publications contains, besides articles on the general and other special subjects of medicine, a number of chapters dealing with surgical subjects of timely value Among these chapters is one on skin-grafting in the treatment of the large ulcers following burns This chapter presents some modifications of the methods in use, and reports a series of cases showing some excellent results Another interesting chapter is on the starvation of malignant growths by depriving them of blood supply A new operative method for the total extirpation of the larynx is described The final two surgical chapters are upon the treatment of knee-joint disease, and the treatment of Glenard's disease

Vol II contains chapters on lateral curvature of the spine, chronic arthritis, tuberculous spondylitis and coxitis, nerve

anastomosis for the cure of infantile palsy, the operative treatment of constipation, gastric surgery, the symptomatology and diagnosis of Glenard's disease, and post-climacteric hæmorrhages. All of these chapters present material of modern interest.

One of the most important and valuable features of the first volume is a *résumé* of the progress of medicine during the past year. All subjects which are attracting present-day interest, and which have been discussed in current medical literature, are presented briefly in the light of whatever new knowledge has been brought to bear upon them.

J P WARBASSE

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## CORRESPONDENCE.

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EDITOR ANNALS OF SURGERY

MY paper on "Scopolamine-Morphine Anæsthesia" in the August issue contains a serious error. It gives the dose of scopolamine as "one-tenth milligramme," whereas it ought to be "one milligramme."

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In treatment the first indication is to increase local capillary circulation. A local remedy must fill two requirements, *ie*, a detergent antiseptic and a degree of permanency in effect. Many of the remedies which have been advocated for the varied forms of tonsillitis are antiseptic, but they are not sufficiently exosmotic in their action to increase the circulation, or else their effect is too transient. Glyco-Thymoline, frequently applied in a 50% strength with a hand atomizer produces a rapid depletion of the congested area through its well defined exosmotic property, re-establishing normal passage of fluids through the tissues, promptly relieving the dry condition of the membrane and giving an immediate and lasting anodyne effect. As a gargle, a 25% solution may be effectively used, providing the process does not cause undue pain. The external application of cloths dipped in hot water and Glyco-Thymoline in a 25% solution greatly increases the venous circulation.

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## HEMORRHAGE FROM THE BLADDER

Dr Charles D Camp, Chicago, reports the following case of hemorrhage from the bladder which he considers to have been of tuberculous origin

J K —Age 45, called April 20th, stating that he had had a hemorrhage from the bladder and had been under treatment by a prominent physician of this city—a specialist in genito-urinary diseases, he was pale, exsanguinated and weak from loss of blood, with a hard, painful lump in right groin, very tender on pressure. By use of catheter, drew off urine, which was about four ounces, and about one half was blood, with some coagulated shreds following. With hypodermic needle, injected in the lump, which was three inches in length, in three places with five minims of cresylone. This gave him great relief. I washed out the bladder with alum solution, and told him to report next day, which he did. The hemorrhage was the same, but the soreness was gone. I then washed out the bladder with solution of lead and alum (Bilroth's solution) and had him report again the next day, the hemorrhage had been the same. Then I washed out the bladder with Eusoma, one part to three parts of water, and had him report the next day, when to my surprise he stated that there had been only a trace of blood, which he said had not shown until four hours before. I then provided him with a soft catheter and had him use the Eusoma twice a day, morning and evening, with the result that the blood entirely disappeared and has not shown a trace but once, which was about a week ago, when he had failed to use the Eusoma as directed. While using the Eusoma as a wash, I have given him an antiseptic tonic by the mouth. His appetite has much improved, his color is nearly normal, he has gained three pounds in weight, and feels much better. He is following his vocation as a barber and bids fair to make a full recovery. —*The Medical Herald*

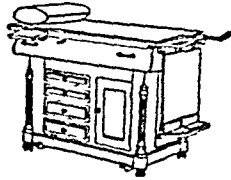
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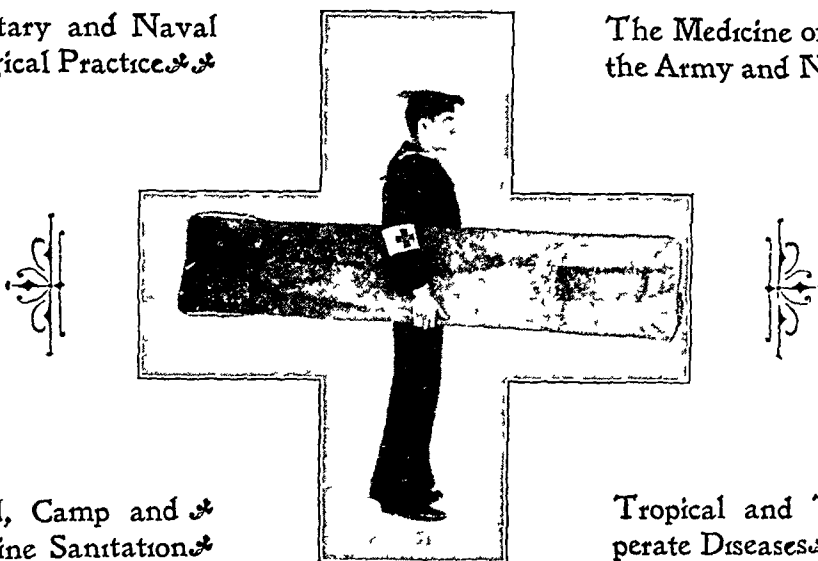
EDITED BY

**James Evelyn Pilcher, M.D., Ph.D., L.H.D.,**

Major and Brigade Surgeon of United States Volunteers,  
Captain, Retired, in the United States Army

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**Carlisle, Pennsylvania.**

## GLYCO-THYMOLINE AS AN ORO-NASAL AND A GENERAL ANTI-SEPTIC

By DAVID WAISIL, M D, Senior Physician,  
Western Skin Hospital, London, W,

Glyco-Thymoline was brought to my notice as an excellent lotion for nasal and oral sprays and washes. On due inquiry it was found to fulfil the conditions usually recognized by medical men in the United Kingdom as vouching for the character, so to speak, of such a preparation, its composition is not a secret, its formula being freely published. Under these circumstances, I determined to try the effect of this preparation in a few suitable cases. As a general antiseptic fluid that does not coagulate albumen, and is non-irritant, deodorant and practically non-poisonous, Glyco-Thymoline has clearly a wide range of usefulness. My own observations, however, have been practically confined to its use in the nose and mouth, with results that have proved satisfactory in every instance, especially in acute coryza, pharyngitis, influenza, and septic conditions of the mouth.

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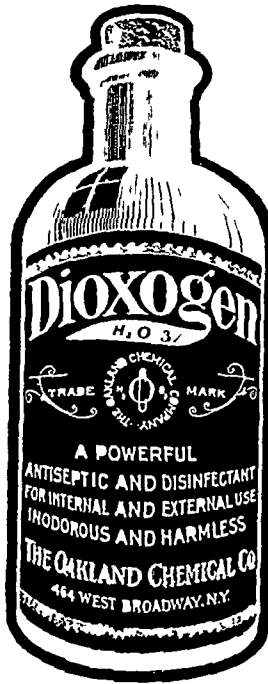


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## MODERN THERAPEUTICS AND PHARMACY

By FREDERICK HADRA, M.D.,  
OF SAN ANTONIO, TEXAS

In speaking of ethical proprietaries, he says "I should be sorry, indeed, if the prejudices of any member of this society should so far overcome his better judgment as to banish all or most of these drugs from his practice without investigating their merits. So, if we desire a local antiphlogistic effect, and we have to choose between the ancient, unsightly, unhygienic and troublesome flax-seed poultice and the newer proprietary article called Antiphlogistine, a physician must needs be prejudiced, indeed, who will prefer the former. It may be a matter of theoretical indifference what preparation we prescribe, but it may be quite a different matter with the patient who has to use it for long periods."

As regards the refilling by the druggists of prescriptions of proprietary remedies, he says "If I am called to treat a sprain of the ankle, and find it necessary to order an antiphlogistic application, it would be just as easy for the patient to send to his druggist daily for more flax-seed meal or iodine, as it would be for him to order more cans of the more cleanly proprietary preparation, Antiphlogistine. A tonic or cough medicine, quinine mixture or capsule would share the same fate whether proprietary or extemporaneous."

"If the intelligent use of the drugs mentioned is not injurious *per se*, why should we protect the laity against their use any more than against the employment of any other drugs? Would the committee advocate the abandonment of calomel, castor oil, mag sulph, quinine, flax-seed meal, paregoric, laudanum or carbolic acid because the laity can also go to the drug store and purchase these just as they can Cascara preparations, Phenacetin, Listerine, Antiphlogistine etc?"

—Extracts from an article in the *Texas Medical Journal* for March, 1905

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but which are without any guarantee or standard whatsoever of purity, quality and strength

Not content with marketing an inferior article, these manufacturers reached the point at last—in their Greed of Gain—of offering a *toxic* one, fortified with Methyl Alcohol (*poison*) or Formaldehyde (*poison*) or both, instead of with pure grain alcohol to the imminent peril of physicians prescribing and patients buying and using it

So ripe have these pernicious conditions become that the State Legislatures of New York and Illinois have been constrained thereby to enact laws which make it an offence punishable by heavy fine, or imprisonment, or both, to sell any medicinal extract containing Wood Alcohol (*poison*) or Formaldehyde (*poison*) or both unless the bottle containing the same be labeled POISON, and other States throughout the Union are taking steps, one after another, to the same protective end

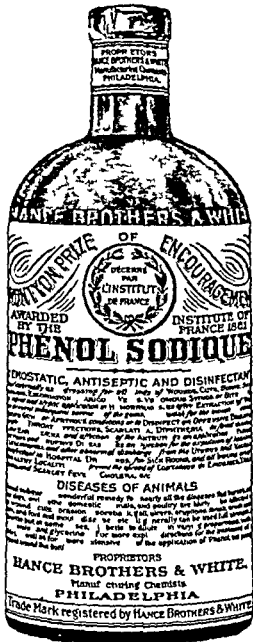
In order, therefore, that profession and patients alike may be secured against the poison perils of the unidentified and adulterated witch hazels of the market we are impelled to publish the following

### CAUTION

"Witch hazel" is not synonymous with POND'S EXTRACT. Analysis of 70 samples of witch hazel offered as "the same thing" showed 52 to contain Wood Alcohol (*poison*) or Formaldehyde (*poison*) or both. The peril of these poisons and the penalties specified above may be entirely avoided by the exclusive prescription and use of

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with  
Antitoxin

Beginning or  
early stage of  
diphtheria

## MULFORD'S ANTITOXIN

Second day of  
disease  
Note develop-  
ment of mem-  
brane

### "SAVES MOST LIVES"

Twelve hours  
after injection of  
Mulford's Antitoxin  
Note line of demar-  
cation above the ton-  
sils exfoliation and  
shrinking of mem-  
brane

Until these condi-  
tions are noted con-  
tinue administration  
of 1000 units every six  
to eight hours—full  
doses are harmless.

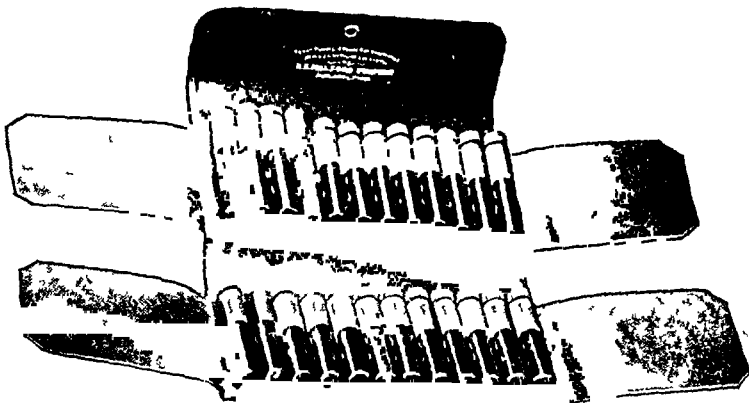


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**E**VERY physician appreciates his medicine case, and it is because our cases differ from all others on the market that we make these special offers

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Some years ago we took up the manufacture of physicians cases and by introducing special features our cases are recognized as the best made. The record of having supplied most of the cases sold in this country during the past five years is proof of this statement



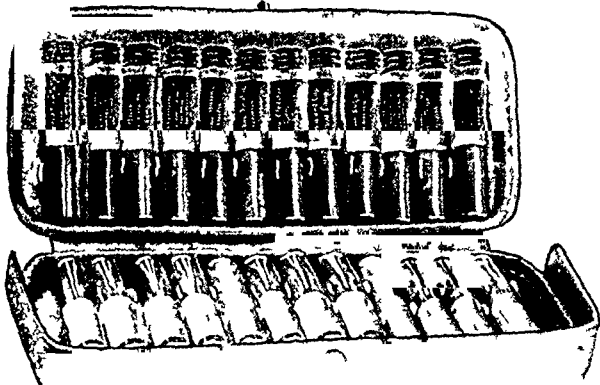
Size 7 1-8 x 3 3-4 x 1 1-2 inches

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Soft flexible case, black seal-grain leather, contains twenty-four 2-dram screw-cap vials (cork vials if preferred), pocket for sundries, flat catch, fitted with our patent spring clasps for holding bottles

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Size 8 x 3 1-2 x 1 5-8 inches

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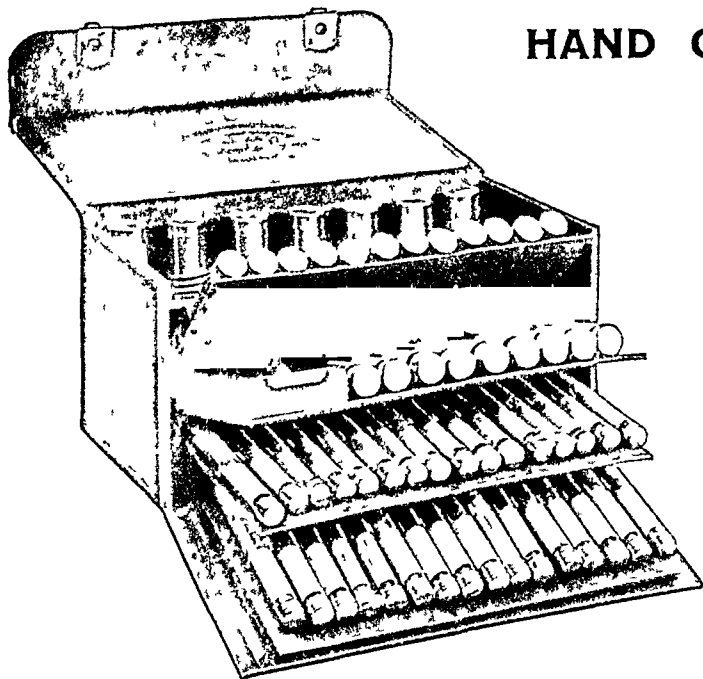
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1 tube Morphine Sulph	1-4 gr	No 74
1 tube Atropine Sulph	1-150 gr	No 98
1 tube Nitroglycerin	1-100 gr	No 110
1 tube Strychnine Sulph	1-20 gr	
1 tube Adrin and Sparteine (Heart Tonic)		

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Most  
Lives"**



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**ASEPTIC GLASS SYRINGE**  
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Mulford's serum syringe is used as indicated in the illustration. The rubber plug not only serves to retain the serum in the barrel of the syringe but also acts as a washer when the plunger is pressed against it to expel the Antitoxin. Rubber is used for making the plug for the same reason that the exacting surgeon uses rubber gloves—to insure absolute asepsis.

Mulford's serum syringe is supplied with finger-rests that permit injecting the serum with one hand, allowing the use of a free hand for controlling the patient.

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The entire package, with needle and plunger, is carefully sterilized in the laboratory before the syringe is filled.

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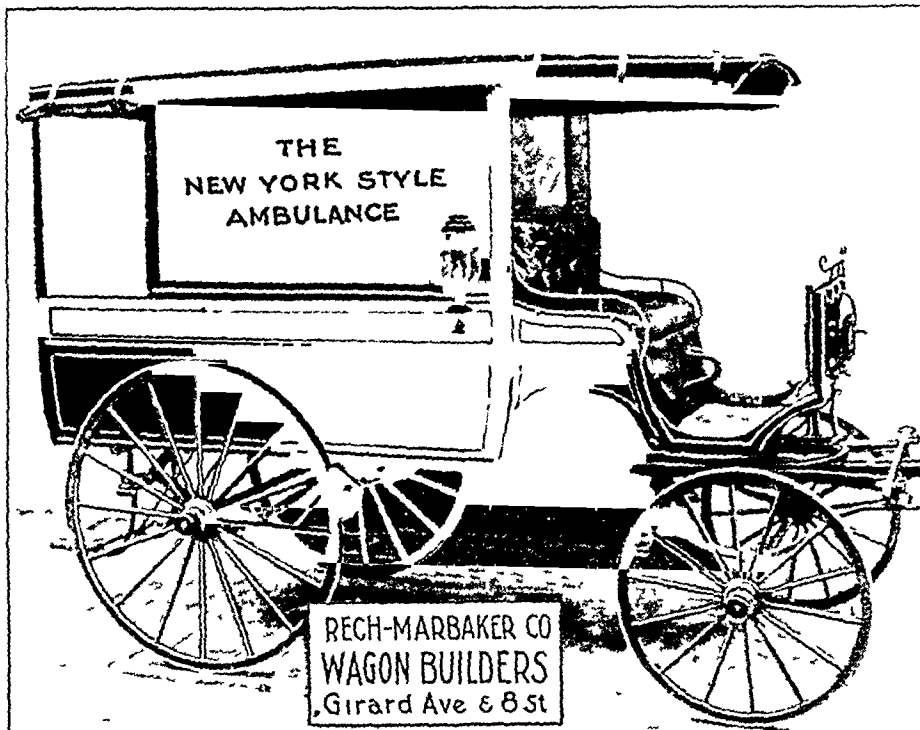
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Old price	\$2 00	\$3 50	\$5 00
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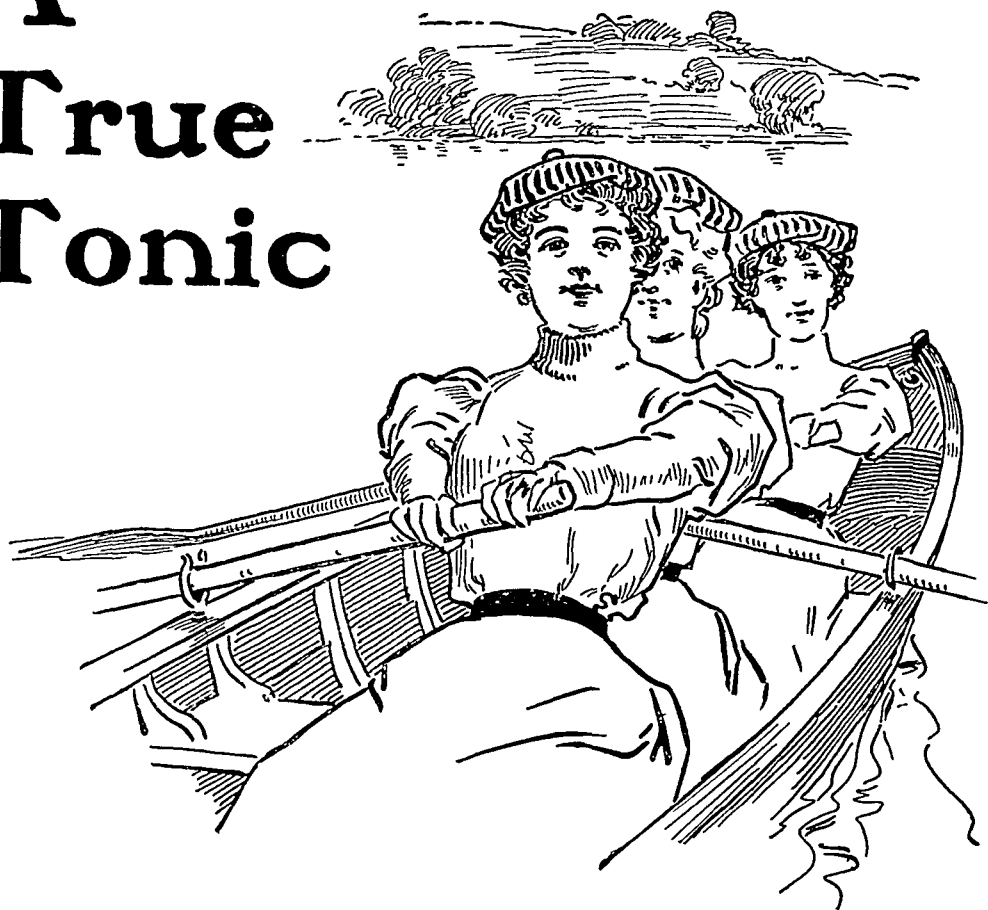


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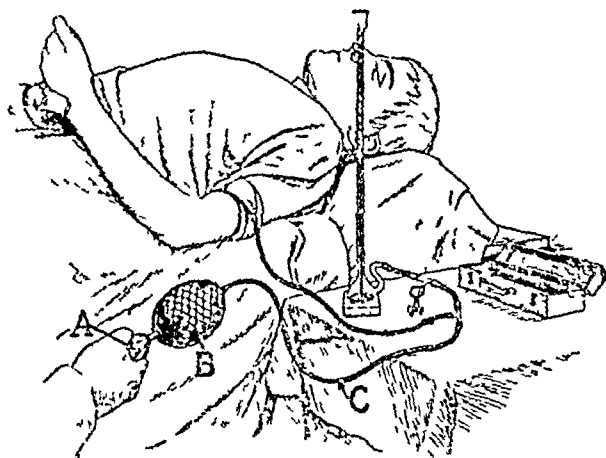
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# An Autumn Prospect

The October issue of LIPPINCOTT'S MAGAZINE will be noteworthy in three respects. It will contain a novelette of swift movement and compelling interest, "A Manila Madness," by Frederic Reddale, dealing with the ingenious and sensational intrigues of a discredited army officer, both in the Philippine Islands and in the States, it will print a long story by the late John Hay, "The Blood Seedling," written with all of that remarkable man's fidelity to essential detail and deep knowledge of the human heart, it will present a group of effective short stories by Cy Warman, Caroline Lockhart, Robert Gilbert Welsh, Helen Sherman Griffith, and other writers no less capable, and—this makes a fourth noteworthiness—a delightful travel paper by Maud Howe "Anacrap' One of the Seven Jewels." With mirthful "Walnuts and Wine" to top off, this seems a pretty good Autumn Prospect.

## Lippincott's Magazine for October

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*umn, thus facilitating rapid and accurate reading*

*It is clothed in an entirely new typographical dress*

*Not one of the features is omitted which have made the United States Dispensatory the standard pharmaceutical authority—wherever the English language is spoken*

**THE EDITORS**

The editorial staff has not been changed for twenty years.

DR. H. C. WOOD, LL.D., continues to edit the medical portions of the work, and still retains his position as President of the National Convention for revising the United States Pharmacopœia.

PROFESSOR JOSEPH P. RIMINGTON, Ph.D., F.C.S., remains in editorial charge of the pharmaceutical, chemistry, and since the last revision published he has been a member of the Committee of Revision of the United States Pharmacopœia.

PROFESSOR SAMUEL P. SARTER, Ph.D., F.C.S., has revised the theoretical chemistry and manufacturing processes and chemical statistics of the work, and since the last revision he has been appointed Chairman of the Sub Committee on Organic Chemistry for the Eighth Revision of the United States Pharmacopœia.

There have also been added to the editorial staff a number of experienced assistants, to hasten the completion of the work.

**THE PUBLISHERS**

The publication of the book has remained for seventy years with J. B. Lippincott Company. It is printed bound and sold by this firm, who were also selected by the Board of Trustees of the United States Pharmacopœial Convention to print and bind the new Pharmacopœia. They have much pleasure in announc-

ing the active preparation of the new United States Dispensatory, which will be issued at an early date.

Notwithstanding the greatly increased cost of production of the new edition there will be no increase in price to the buyer.

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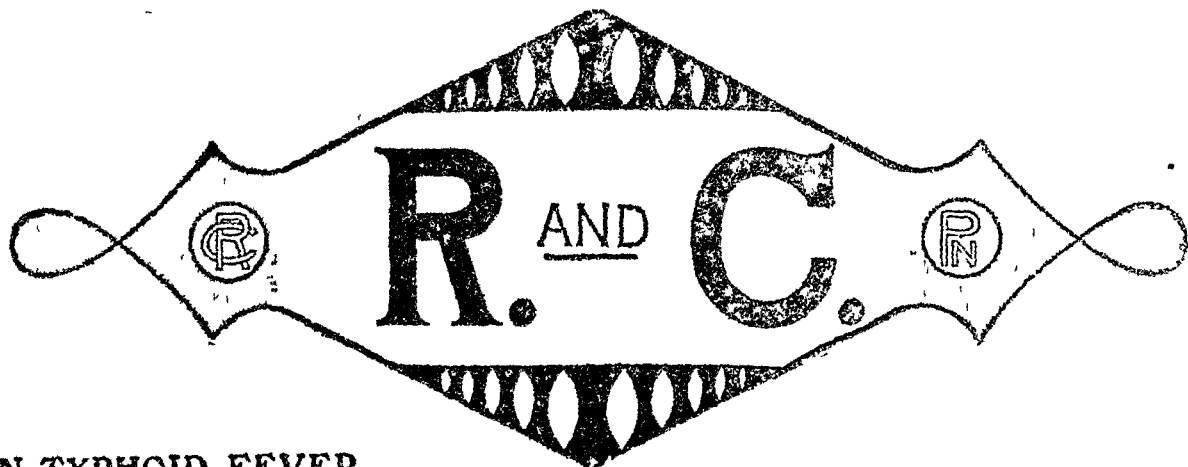
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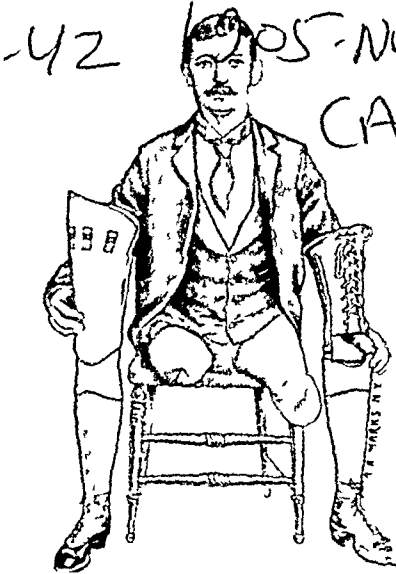
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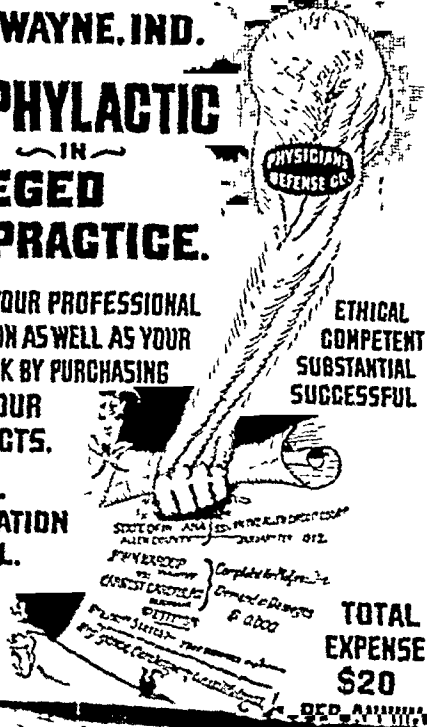
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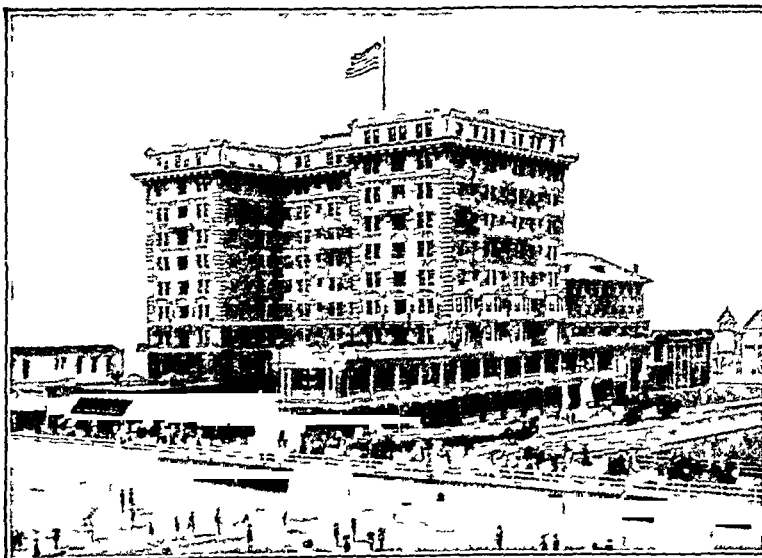
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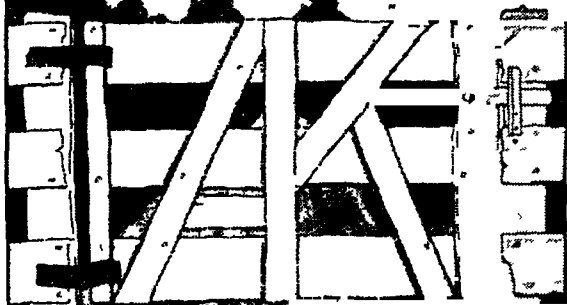
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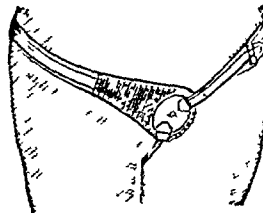
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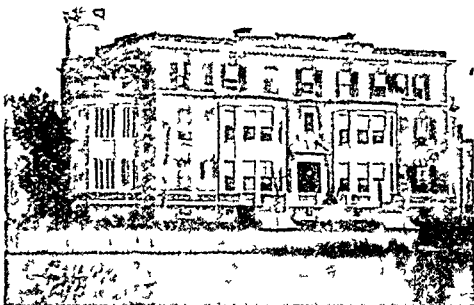
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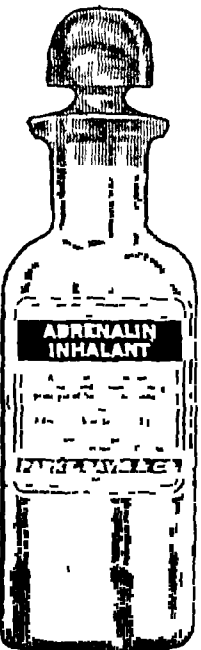
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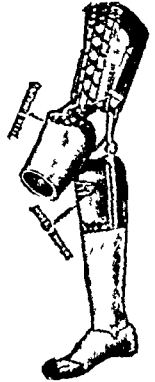
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# ANNALS OF SURGERY

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## ORIGINAL MEMOIRS.

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### FINAL RESULTS IN THE X-RAY TREATMENT OF CANCER, INCLUDING SARCOMA.<sup>1</sup>

BY WILLIAM B COLEY, M D,

OF NEW YORK,

Attending Surgeon to the General Memorial Hospital, Associate Surgeon to the Hospital for  
Ruptured and Crippled

SINCE February, 1902, or a period of over three years, I have made an earnest endeavor to determine the value of the X-ray in the treatment of malignant tumors

At the beginning of this period there had been published a few reports of remarkable cases of cancer that had disappeared after a few weeks' or months' treatment with the X-ray. While most of these cases were of the cutaneous variety, or superficial epitheliomas, there were, in addition, a number of cases of recurrent cancer of the breast and two cases of inoperable sarcoma of the neck.

These reports gave rise to the hope that in the X-ray we had at least found something that offered relief, and perhaps cure, to that large class of patients afflicted with recurrent inoperable cancer, and possibly offered to patients suffering with primary cancer in the earlier stages, a larger prospect of cure than surgical operation.

Until it had been demonstrated that these apparently successful cases had remained free from recurrence sufficiently

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<sup>1</sup> Read before the New York Surgical Society, May 10, 1905



long to entitle them to be called cures, I then believed, and have since maintained, that the treatment should be strictly limited to inoperable and recurrent cancer, or applied as a postoperative measure that might possibly render recurrence less likely to take place

The after-histories of these cases apparently successfully treated by the X-rays has proven the wisdom of such a course

At the General Memorial Hospital, in February, 1902, through the liberality of Mrs Collis P Huntington and Mr Archer M Huntington, two X-ray machines were installed, and the work has been maintained up to the present time under the charge of Mr W P Agnew and Dr James Ogilvie, who have treated the cases under my direction during this period

During this time there have been treated, including a few cases treated by myself personally outside of the hospital, 176 patients, as follows 68 cases of sarcoma, 36 of carcinoma of the breast, 44 of epithelioma of the head, face, and neck, including tongue, 14 of deep-seated abdominal growths, probably carcinoma, 5 not classified, 3 of tubercular glands of the neck, 3 of Hodgkin's disease, 3 of lupus

This gives us 167 cases of malignant tumors, sarcoma or carcinoma, in a total of 176 cases

In five of the sixty-eight cases of sarcoma complete disappearance was observed, but in every one of these cases there was a recurrence a few months later In two of these cases the recurrent growths disappeared again under the combined X-ray and toxin treatment These two cases are still well at present Of the other cases one died of internal metastases, one a sarcoma of the pectoral region and axilla was a local recurrence, the fifth case, a sarcoma of the chest-wall, involving the ribs and pleura, disappeared under the combined treatment with the X-rays and toxins, the X-rays having never been used alone In this case there has recently been a recurrence which thus far has not yielded to further treatment with the X-rays or toxins

In one case, a very rapidly growing sarcoma of the orbit with extensive involvement of the lymphatic glands of the

neck, very marked improvement followed the use of the X-rays, the glands of the neck nearly disappearing under a few weeks' treatment, and the tumor of the orbit also diminishing in size. The improvement, however, was of very brief duration, the tumor soon began to increase again rapidly and caused death in a few months.

The X-rays were used in three cases of melanotic sarcoma, starting in the skin of the ankle in two cases, and involving the femoral and iliac glands. In one case the X-rays were used for nearly two years, and seemed to have a decided influence in retarding the progress of the disease, in the other two, which were of much more rapid growth, the effect was apparently *nil*.

After having given the X-ray a very careful trial in sixty-eight cases of sarcoma in almost every locality, I am forced to the conclusion that, while in certain rare cases, especially of sarcoma originating in the lymphatic glands, improvement may be very striking, going so far, in some cases, as to cause entire disappearance, there is almost always a speedy recurrence, either local or metastatic, and that the influence of the X-rays upon sarcoma is rarely, if ever, curative. The case of Skinner may prove the single exception to this rule, although sufficient time has not yet elapsed to justify us in considering it a cure (See elsewhere.)

The following is a brief history of the cases of sarcoma that disappeared under the influence of the X-ray or the X-ray and toxins combined, traced to final results.

CASE I—*Extensive Recurrent Round-celled Sarcoma of the Neck, Both Sides, Superior and Infraclavicular, Pectoral and Axillary Regions on One Side, and Mediastinal Glands*—The early history of this case is given in full in the *Transactions of the American Surgical Association*, 1902. The patient, M. A., aged forty-five years, was confined to bed and in such a hopeless condition that she was not expected to live more than two months. The toxins had been used with improvement at first, and finally abandoned. On February 10, 1902, at the General Memorial Hospital, I began the X-ray treatment purely as an experiment. The

improvement was more striking and rapid than in any other case that I have observed. The tumors steadily disappeared, and by July 1 there remained only a small nodule, the size of an almond, anterior to the sternomastoid muscle. This I removed under ether purely for pathological study, and the examination by Dr George P Biggs, of the New York Hospital, confirms the original diagnosis, and is of great interest. The patient regained her normal strength, and spent the summer in the country. She returned on September 24 with a local recurrence, the size of an English walnut, in front of the ear in the lower portion of the parotid. Both groins were filled with multiple tumors, varying in size from a hen's egg to that of a pigeon's egg. In addition, there was an intra-abdominal tumor, the size of two fists, smooth, globular, fairly movable, apparently originating in the ascending colon or its mesentery. There was undoubted constriction of the bowel at this point. Her condition again seemed hopeless. I resumed the X-ray treatment, and in three weeks the nodule in the parotid region had entirely disappeared, and the groin tumors disappeared within six weeks, and the growth in the abdomen decreased to about one-half its former size.

The treatment was kept up during the entire winter with steady decrease in the size of the abdominal tumor, and, continued in the summer of 1903, at Dartmouth, New Hampshire, under the general supervision of Dr C B Nancrede. When the patient returned to me again in the fall, another nodule had appeared in the cervical region, the tumor in the abdomen seemed to be somewhat larger, and a few nodules were beginning to appear subcutaneously in the region of the thighs and abdomen. Her general health, too, had deteriorated. The X-ray treatment was again applied for a few weeks, but she grew worse very rapidly, new tumors appearing almost every day. Towards the end she suffered a great deal of pain in the sciatic and crural nerves. She died in June, 1904. At the time of her death, in addition to a large tumor in the abdomen, there were hundreds of nodules varying in size from a pea to a small egg, situated in the subcutaneous tissue and scattered over the entire body. One of these nodules was removed and examined at the Loomis Laboratory by Dr B H Buxton. Examination showed it to be the same type of growth as all of the other specimens, namely, small round-celled sarcoma, apparently very little changed by the treatment.

CASE II—*Small Round-celled Sarcoma of the Pectoral Region*—E M, aged thirty-five years Family history good Had been twice operated upon for round-celled sarcoma of the right pectoral region by Dr Maurice H Richardson, of Boston, and a microscopic examination made by Dr W F Whitney at the Massachusetts General Hospital proved the growth to be round-celled sarcoma The last operation was performed in October, 1901 The disease then involved the pectoral and axillary regions so widely that it was impossible to make a complete removal Amputation of the upper extremity was considered, but not thought advisable The patient was referred to me by Dr Richardson in October, 1901 The mixed toxins were administered five to six times a week for three months in doses sufficient to produce a marked reaction The tumor softened, and in January, 1902, a spontaneous opening occurred, with evacuation of about a pint of necrosed tumor tissue, as a result of which the growth was reduced about two-thirds In February, 1902, the X-rays, plus toxins, were administered, causing continued decrease in the size of the tumor In June, 1902, the growth had entirely disappeared, and the patient returned to Rhode Island in good condition He worked hard every day and gained twenty pounds in weight An examination, January 5, 1903, showed the patient's general condition still perfect, but about two inches below the clavicle, in the pectoral region, there was a small movable nodule the size of a hickory-nut He returned to the General Memorial Hospital on February 3, 1903, for the combined toxin and X-ray treatment, with the result that in six weeks the recurrent tumor had again disappeared, his general health remaining perfect

This case was shown before the meeting of the American Surgical Association in June, 1903 In December, 1903, the patient had a slight local recurrence, which disappeared under renewed X-ray and toxin treatment He remained well until the early part of 1904, when he had a local return, which has never entirely disappeared The patient has been able to attend to his regular duties up to the present time In a letter of May 31, 1905, he stated that he was working every day, and that his condition had remained about the same since I saw him a year ago, since which time he had gone entirely without treatment On July 5, 1905, I examined him, and found him with extensive local

recurrences and evidences of extension into the lung and pleura. He was much emaciated, and his condition hopeless.

CASE III—*Small Round-celled Sarcoma of the Back*—W J, aged eleven years. Family history good. In the latter part of August, 1901, the patient fell from a stoop, striking on his back. Two or three weeks later the mother noticed a swelling in the midscapular region, a little to the left of the median line. This swelling increased very rapidly. It was soft and fluctuating from its beginning. The patient was referred to me in December, 1901, by Dr Polhemus, of Nyack, New York. Physical examination at that time showed a cystic swelling the size of an orange in the left scapular region. The skin was normal, the tumor fluctuating, situated apparently just beneath the skin and superficial fascia. On January 12, 1902, an incision was made under ether and several ounces of dark blood were evacuated. There was no evidence of any solid tumor at this time. The wound closed without drainage and healed by primary union. About three weeks later a tumor began to develop at the original site, this was also cystic in character, increased rapidly in size until May, when it had become one-third larger than at the first operation. I then operated again under ether anæsthesia, finding at this time, in addition to fluid blood and clots, such a thickening of the walls of the cyst as to make me suspicious of sarcoma. A portion of this thickened tissue was removed and examined by Dr H T Brooks, Professor of Pathology at the Post-Graduate Hospital, who pronounced it small round-celled sarcoma of high vascularity. Two weeks after the operation and before the wound had entirely healed, the X-ray treatment was begun and continued three times a week. The treatment was kept up the entire summer and fall of 1902. In December, 1902, there was well-marked evidence of local recurrence in and about the cicatrix. The tumor continued to increase in size in spite of X-ray treatment. On January 26, 1903, I operated a third time under ether anæsthesia and removed the recurrent tumor together with the old cicatrix. The wound healed by primary union. Shortly after he left the hospital, the X-ray treatments were resumed, and continued once or twice a week during all of 1903 and the first half of 1904. In June, 1904, there began to appear signs of another recurrence in the old cicatrix, and this time, in addition to the X-ray, I began the local injections of the mixed toxins of erysipelas and Bacillus pro-

digiosus The injections have been continued from July 1 up to the present time, June 19, 1905, two or three times a week, with two X-ray treatments a week, with the result that the recurrence slowly disappeared, the ulcerated area healed over, and at the present moment there is no trace of a growth anywhere visible The boy's general health has remained perfect up to the present time

CASE IV—*Round-celled Sarcoma of Femur involving the Lower Two-thirds of Shaft*—A G, aged nineteen years A swelling was first noticed in the lower portion of the femur in November, 1901 This gradually increased in size, being accompanied by loss of weight and deterioration of general health Physical examination on February 5, 1902, showed a large tumor extending from the condyles of the left femur to the junction of the middle and upper third There was a fusiform enlargement of the entire lower two-thirds of the femur On the outer aspect of the thigh, about one and one-half inches above the joint, there was a soft, fluctuating area just covered by thin and reddened skin There was slight impairment of the functions of the joint itself An incision was made under ether into the fluctuating area, and two to three ounces of clear serum, similar to that which is found in cystic degeneration of sarcomatous tissue, were evacuated A curette was passed into the cavity of the bone and typically sarcomatous tissue removed Microscopic examination by Dr E K Dunham showed it to be a round-celled sarcoma The patient absolutely refused amputation at the hip, which I strongly advised

The X-ray treatment was tried entirely as an experiment, four exposures a week being given for a month, at the end of which time the circumference of the tumor had decreased one inch The treatment was discontinued for two weeks, during which interval the tumor had again increased nearly an inch The treatment was resumed, and at the end of another month the circumference of the thigh over the centre of the tumor was one inch less than the original measurement The treatment was continued the entire summer to December, 1902 At this time the measurement of the left leg was the same as that of the right There was still some thickening in the lower part of the femur The old sinus, which had never healed after the exploratory incision, was enlarged under ether and carefully curetted Examination of the

tissues failed to show any trace of sarcoma. The patient had gained twenty pounds in weight, but towards the end of December, 1902, began to show signs of a metastatic tumor developed in the left pectoral region, this grew rapidly until it became about the size of a hand, when it was partially removed under ether anæsthesia, it was found to be very soft and highly vascular. Shortly after this, a large tumor, the size of a child's head, developed in the right iliac fossa, extending from the costal cartilages down to the pelvis, it could be easily felt in the lumbar region. The local treatments with the X-ray in the femur and pectoral regions were continued, and in addition the mixed toxins of erysipelas and *Bacillus prodigiosus* were begun. After a few weeks the large tumor in the ilio-lumbar region began to soften and break down, and on becoming completely fluctuating was opened posteriorly. A very large amount of necrotic tumor tissue was evacuated and the sinus was drained for about a year. While the tumor in the leg had apparently disappeared, there remained a marked thickening of the bone, and the sinus leading to the broken-down area persisted. Examination of several curettings failed to show any longer evidence of sarcoma. At the present time, three and one-quarter years after beginning of treatment, aside from the sinus in the leg, the boy appears to be in perfect health. There is at present no evidence of sarcoma to be found.

CASE V—*Inoperable Round-celled Sarcoma of the Chest-wall, Involving Ribs, treated by the X-rays combined with the Toxins of Erysipelas and Bacillus Prodigiosus*—G. C., sixteen years of age, enjoyed good health up to 1903, when he had an attack of what was considered to be pleurisy with effusion. He was aspirated, but the dulness over the chest persisted, and he rapidly lost flesh and strength. He was sent south, without improvement, and in October, 1903, entered the Johns Hopkins Hospital, where he was operated upon for a supposed empyema. A large incision was made, revealing a necrosis of the eighth and ninth ribs, and behind these some gelatinous masses were found. These were partially removed and examined by Dr. Welch who pronounced them round-celled sarcoma. The patient was referred to me, and on May 26, 1904, was admitted to the General Memorial Hospital, where for two months the toxins were regularly administered, in addition, he received X-ray treatment.

three times a week. At that time the patient was so weak that he could hardly walk. There was a mass about the size of a man's hand over the ribs, with an extensive, sarcoma-like sloughing area in the centre. The improvement was very rapid, and when he left the hospital in the fall of 1904 there was no trace of the tumor left, the patient had gained twenty-five pounds in weight and seemed in perfect health. He returned to his home in Canada, where his family physician had been instructed to continue the toxin treatment in smaller doses two to three times a week.

By the end of January, 1905, the patient returned to New York for examination, and there was evidence of a local recurrence, which at first again showed some improvement, after a few weeks, however, the tumor began to slowly increase in size in spite of large doses of the toxins and regular and prolonged X-ray treatment. The growth was thoroughly curretted in March and again on June 8. At the last operation a mass of soft, vascular sarcomatous tissue, about the size of a small orange, was scooped out with a large spoon from within the chest-wall. Hæmorrhage was very profuse, but was finally stopped by tight packing. After an infusion the patient rallied well from the operation. At present there remains an area of tumor tissue on all sides of the cavity, involving the bony structures as well as the soft parts and extending deeply into the lung. The prognosis seems hopeless. *Death Nov. 1905. T.W.C.*

CASE VI—*Inoperable Intra-abdominal Sarcoma involving Mesentery, Mesenteric Glands, and a Portion of the Small Intestine, which disappeared entirely under Four Months' Treatment with the X-rays and Toxins combined*—Mrs W. was operated upon in November, 1903, by Dr William M Conant, of Boston, for abdominal tumor. It was thought to be connected with the uterus or ovary, but an infiltration into the small intestine was found. There was also in the posterior peritoneal part of the mesentery a growth fully as large as the closed fist. The growth was so extensive and suspicious that no attempt was made to remove it. Pathological examinations made by Drs W. F. Whitney and A. C. Potter proved the disease to be round-celled sarcoma. The patient was then referred to me by Dr Conant, and I began the combined X-ray and toxin treatment, with the result that the tumor entirely disappeared in four



months' time After this the patient developed high temperature with acute abdominal symptoms, pointing to local peritonitis She was desperately ill and all hope of life was abandoned for more than a week A fæcal fistula finally developed, and she slowly recovered her health She is alive at present, one and a half years afterwards In January, 1905, a small mass could be felt in the lower portion of the abdomen, at the site of the original tumor, and, as it increased slowly in size, the treatment was resumed by her former physician, Dr W E Wilson, of Pawtucket The growth has not again disappeared, though there has been improvement

### CARCINOMA OF THE BREAST

The thirty-six cases of cancer of the breast treated by the X-ray furnish almost every variety of the disease, from the cancer "en cuirasse," with extensive lymphatic involvement and œdema of the arm, to the small, superficial, recurrent cancerous nodules along the site of the old cicatrices In addition, the X-ray was used in four cases as a prophylactic immediately after operation for the primary growth I regret to say that these cases furnish little encouragement for the use of the method as a prophylactic measure, since in every instance a recurrence took place within a few months, while the patient was still undergoing the treatment While in one case there was no definitely recognized recurrence in the pectoral or axillary regions, the patient died of general metastases within a year's time In two other cases, very small recurrent nodules, just beneath the skin in the neighborhood of the old cicatrix, disappeared after a few weeks' treatment, but in both cases there was a speedy return, and the treatment seemed to have little effect in checking the steady progress of the disease towards a fatal issue

In one instance the X-ray was used in a primary operable tumor, presenting all the clinical appearances of carcinoma, although no microscopical examination was made Every effort was made to induce the patient to submit to an operation, but she absolutely refused She was told that the X-ray treat-

ment was purely experimental and probably would do no permanent good

The patient, aged forty-five years, married, with negative family history, had a tumor in the right breast of about eight years' growth. No history of trauma. Examination made in April, 1902, showed a tumor of about the size of a large English walnut in the upper portion of the right breast. The tumor was very hard, the skin was adherent, axillary glands were not involved. The patient was given the X-ray treatment three times a week during the spring and summer of 1902, with the result that there was some decrease in the size of the tumor and increase in mobility. On discontinuing the treatment for a few months, the tumor again began to increase in size. She received intermittent treatment up to two months ago, and sometimes would go several months without any exposures. At present the tumor is about the same as it was three years ago. There is still no involvement of the axillary or mediastinal glands.

I do not feel absolutely sure that the case is carcinoma, although from the clinical appearances I have little doubt. If so, the disease has certainly been held in check for three years, although of late her general health is not so good, and she has had a severe bronchitis, which may be evidence of internal metastases.

In my entire experience with the X-ray, I have seen but one case of deep-seated carcinoma in which the tumor disappeared.

The patient, Mrs. M. D., forty years of age, married, no children, was suffering from a very extensive ulcerative carcinoma of the right breast which had destroyed the entire breast, involving periosteum of the ribs and sternum. The X-ray treatment was begun in December, 1902, and continued until May, 1903, during which time the disease apparently completely disappeared. The patient's general health remained good. About a year ago she had a severe attack of pleuritis, which was supposed to be an extension of the disease into the pleura and lung, and for a number of weeks she was not expected to live. She

gradually recovered her health, however, and for nearly a year has been able to be up and about. During this time there has been gradual extension of the disease into the other breast, which is now completely involved, and physical examination shows undoubtedly the presence of large deposits in the right lung, which cause her a good deal of dyspnoea on exertion. She has marked dilatation of the right pupil, and, after gradual diminution of vision, she is now totally blind on the right side. The X-ray treatment has been continued almost the entire time during the last year. At present she is up and about and goes out every day, although her general condition is gradually failing. She has recently developed slight facial paralysis.

In this case the X-ray has undoubtedly prolonged her life for a considerable period, although the tumor originally was of comparatively slow growth, having existed nearly three years prior to the beginning of the X-ray treatment.

#### EPITHELIOMA

We have treated forty-four cases of epithelioma of the head, face, and neck. In this number are included cases of epithelioma originating in the lip or tongue, later involving the glands of the neck. Ten cases were epithelioma of the nose, ten superficial epithelioma of the face. In only four cases did the disease disappear entirely. In every case in which there was involvement of the glands of the neck, no improvement whatever was noticed, and the rays had little, if any, effect in retarding the disease. This was especially noted in tumors originating in the tongue or lip, showing that some of the very small epitheliomas of the face often fail to yield to X-ray treatment. I will cite one case of epithelioma involving a small area of the lower eyelid and the skin in the region of the inner canthus, which was treated for a period of seven months without disappearance. Another case, an epithelioma of the face, but little larger than a pea, but involving the deeper layers of the skin, showed no improvement after two months' treatment with the X-rays. The patient submitted to excision, which had been strongly advised at first.

The X-ray was used in four cases of carcinoma of the abdomen probably originating in the sigmoid or cæcum, and in one case of high rectal cancer with extensive involvement of the sigmoid. In the latter the growth decreased slightly in size and the pain was somewhat controlled by the X-ray treatment. His condition then grew worse and he died suddenly a short time later. It is very doubtful if his life was much prolonged by the treatment. In the other cases there has been no effect whatever upon the intra-abdominal growths.

Four cases of malignant disease of the larynx and one of the œsophagus showed absolutely no improvement under the treatment.

In one of the three cases of Hodgkin's disease treated with the X-ray, there was very remarkable improvement at first. The glands of the neck, axilla, and groin disappeared entirely, and the spleen, which was of enormous size, decreased to one-third of its original dimensions. However, after about six months the patient had a sudden attack of pain in the epigastrium, with vomiting and jaundice and moderate rise of temperature. The symptoms increased in severity and he died in two weeks. No autopsy. The second case of Hodgkin's disease was not traced, and a third is at present under treatment.

Of the three cases of lupus, the disease disappeared entirely in two and there was marked improvement in the third. In one of the cases of tubercular glands of the neck, the glands markedly decreased in size, in one they disappeared, and in the third case there was slight involvement.

#### CASES OF EPITHELIOMA OR CARCINOMA THAT DISAPPEARED UNDER X-RAY TREATMENT

CASE I—F S, male, fifty-five years old. Superficial epithelioma of the forehead, about the size of a silver half-dollar, of thirty years' duration. Treatment was begun in March, 1902, and continued until April 6, 1903, when it was discontinued on account of a burn. At this time the growth itself had almost entirely disappeared. The patient was examined on May 1,

1905, three years after the beginning of the treatment, and was found perfectly well

CASE II—Mrs S, sixty-three years of age Small epithelioma of the forehead of seven months' duration The treatment was begun in June, 1903, and kept up with intervals of rest until March 30, 1905 May 1, 1905, examination showed no return of the growth

CASE III—Mrs A, aged thirty-four years Small ulcer, one-half inch in diameter, situated upon the end of the nose, about one year's duration In this case the clinical diagnosis was not positive, and it was believed that the ulcer was probably of syphilitic origin It disappeared after one month's treatment, and examination nearly three years later, on May 1, 1905, shows no return of the trouble

CASE IV—Mrs F, forty-nine years of age Recurrent inoperable carcinoma of the cervix First operation was done on September 22, 1901, by Dr C H Fredericks, of the Woman's Hospital, at Buffalo Reappearance of bloody discharge in April, 1902, at which time the case was considered inoperable by Dr Jarman of the General Memorial Hospital X-ray treatment begun May 5, 1902, and continued for about four months, at the end of which time the growth had entirely disappeared The patient is well at the present time In this case, unfortunately, no microscopical examination was made to confirm the clinical diagnosis In view of the fact that the trouble disappeared after such a short period of treatment, the diagnosis of carcinoma cannot be regarded as positive In fact, Dr Fredericks writes me that he is inclined to think there was an error in diagnosis

The only other case that remains well at the present time is the case of sarcoma of the femur already described, in which, six months after the X-ray treatment was begun, extensive metastases occurred in the pectoral region and iliac fossa At this time he was placed upon the mixed toxins of erysipelas and *Bacillus prodigiosus* The large tumor in the iliac fossa broke down and was evacuated After long-continued treatment, the patient is at present well, without visible evidence of a return This case can by no means as yet be regarded as a

cure, although, in view of the fact that so very few cases of periosteal sarcoma of the femur are cured even by hip-joint amputation, or life prolonged beyond two years, the case is of great interest

I have made an effort to trace to final results certain reported successful cases of deep-seated malignant tumors treated by other men

CASE I—*Round-celled Sarcoma of the Neck*, treated by DR. C E SKINNER, of New Haven, and published by Dr Frank A Kirby (*Journal of Advanced Therapeutics*, February, 1902)

The patient, male, aged sixty-four years, three years ago received a blow upon the neck from a wagon-pole, leaving a contusion which lasted about a week. Two months later a swelling appeared at the site of the injury. This grew very slowly for about sixteen months, when the patient severely wrenched his neck. Almost immediately afterwards the tumor began to grow more rapidly, and became painful. By November, 1901, the tumor had become very large, and occupied the greater portion of the left mastoid and cervical region, measurements being seven inches laterally, ten inches vertically, with some ulceration and breaking down. Microscopic examination by Dr Archibald McNeal, of the New Haven Board of Health, showed the tumor to be round-celled sarcoma. The X-ray treatment was begun November 20, 1901, by Dr Skinner, a Van Houten and Tenbrook 32-inch twelve-plate static machine being used. Dr Skinner states that in the incredibly short space of time of six weeks the patient was apparently cured, the tumor having disappeared, the surface healed, and the patient being free from pain, and able to resume his work.

On June 27, 1902, I made a personal examination of this case and found the following conditions

In the left side of the neck and mastoid region is a very large, broad cicatrix, measuring two and one-half by three and one-half inches, but there is absolutely no trace of a recurrent growth. In the lower part of the cervical region there can be felt on deep pressure very slight enlargement of one or two of the deep cervical glands, apparently no longer than peas.

In a letter, received in the latter part of 1903, his physician states that the patient began to lose rapidly in general health, and died about five months later. No autopsy was made, but there is little doubt that his death was due to internal metastases.

CASE II—Male, aged seventy years, with small round-celled sarcoma of the neck, six times recurrent, and apparently absolutely hopeless. The X-ray treatment was begun by Dr E R Fiske, of Brooklyn, on December 22, 1901. A static machine was used daily, and exposures of ten minutes' duration were given the first few weeks, these were gradually lengthened to twenty minutes, and the treatment was continued, with occasional

intervals of rest, for a year At the X-ray meeting of the Academy of Medicine, March 9, 1902, I showed the patient in perfect health, and there was not the slightest suspicion of tumor or induration in the neck A communication from Dr Fiske, dated January 23, 1903, states that the patient is free from recurrence, in fine health, and has gained in weight. In a later letter it is stated that he died on September 23, 1903, under symptoms of cerebral thrombosis Here again there is strong probability that death was due to generalization of the disease

The after-histories of two cases of malignant tumor that had been previously under my care and were later apparently successfully treated with the X-ray by Dr William J Morton, of New York, as reported in the *Medical Record* of March 8, 1902, are of interest

One, a recurrent carcinoma of the breast, the size of a bean, disappeared under three weeks' treatment from January 30 to February 19, 1902, and is reported as cured except as to usual possibility of a recurrence Two months later, however, this patient died of extension of the disease into the lung and pleura

The other case was an extensive sarcoma of the mastoid region in which the mixed toxins had been tried and failed At the time of the beginning of the treatment, January 25, 1902, there was a large bony tumor in front of the ear and a soft tumor, three by two inches in size, behind the ear The patient suffered intense pain and was taking one-half grain of morphia every two to three hours After a few treatments the pain ceased and both swellings decreased in size At the time of the report, February 20, 1902, only a small lump of the soft tumor remained, and the pain had entirely ceased Later, the X-ray lost its influence upon the disease, the patient's general health slowly deteriorated, and she died within three months after the case was reported

In the *Johns Hopkins Bulletin*, June, 1904, p 192, Professor E Schiff, of Vienna, reports a case of cancer of the mamma cured by means of the Rontgen ray The patient came to him on February 7, 1903, with an inoperable cancer of the left breast, extending from the edge of the sternum to the midaxillary region, 8 centimetres in width and 5 centimetres elevation, with an ulcerated surface and five small nodules in the back The X-ray treatment was begun and marked improvement was noted

from the start On June 5, or less than four months from the beginning of the treatment, the last record was made At this time it is stated that "excepting some excoriated patches, a flat scar, crossed by some enlarged veins, had taken the place of the tumor, the cutaneous metastases had disappeared, the group of supra- and infraclavicular glands had decreased in size and become softened" This description of the condition makes it quite clear that the disease had not entirely disappeared Inasmuch as there is no after-history of the case, there seems to be little warrant for reporting it cured

In the *Beitrage zur klinischen Chirurgie*, vol xxxvii, 1903, Mikulicz reports a case of deep-seated cancer of the male breast which apparently disappeared under the use of the X-rays The case is briefly as follows

The patient, a man fifty-two years of age, was admitted to the Breslau Clinic on July 23, 1902, suffering from an ulcerating tumor of the left breast, claimed to be due to an injury sustained two years previously The diagnosis of carcinoma of the breast with metastases in the glands of both axillæ was made It was decided to clean out the axillæ and treat the breast ulcer with the X-rays The operation was performed on July 1, 1902 Microscopic examination of the piece of the breast tumor that had been excised for this purpose showed it to be a simple mammary carcinoma The axillary glands, too, proved to be extensively infiltrated by the disease The X-ray treatment was begun on the 2d of July By the end of the month the ulcer had decreased from 7 by 3 centimetres to 5 by 1½ centimetres A piece was then excised in the neighborhood of the former excision and examination showed no carcinomatous cell present The patient was discharged on the 2d of August, and examination on October 22 showed a smooth scar, pink, soft, and movable No indurated tissue below or around the scar nor in the axillary cavity

In a later paper (*Beitrage zur klinischen Chirurgie*, Band xliii, p 505), Mikulicz gives a complete *résumé* of his results obtained from the use of the X-ray in cancer He reports thirty-seven cases of these eighteen were carcinoma of the skin, two of the buccal cavity, one of the lymph-glands of the neck, five of the œsophagus, and eleven of the breast In the latter series we also find the later history of the above cited case It is there stated that two months later the scar had reopened, evidently as a result of maceration due to inefficient bandages, no local recurrence, but outside of the exposed area, near the axilla, a hard nodule, the size of a bean, was found Extirpation and closure of scar Three months later, local recurrence Excision of recurrent nodules, including portions of scar Re-examination eight months later No recurrence

Mikulicz's results also show the influence of the X-rays upon other than carcinoma of the skin to have been very slight While in a few of his cases of carcinoma of the breast the disease apparently disappeared, recurrence, either local or metastatic, followed in every instance



His conclusions are, that in carcinoma of the skin, especially *ulcus rodens*, so long as the lymphatic glands are not involved, complete cure may be effected by the use of the Rontgen rays, and that in this class of cases the X-ray treatment is of equal value to that of operation, and perhaps even superior, in view of the better scar resulting after the X-ray treatment. He would, however, exclude the treatment in the more deep-seated operable growths, while in the inoperable cases he thinks improvement with a chance of cure may result from the combined preliminary operative and subsequent X-ray treatment.

As regards operable cancer of the breast, he believes these cases should never, even under most favorable circumstances, be subjected to X-ray treatment, since here all depends upon attacking the entire lymphatic region, and while the knife may accomplish this, he knows of no case in which the X-rays have been successfully employed. The Rontgen-ray treatment should be strictly confined to inoperable cases, in which it may cause improvement, though hardly ever a cure.

There is a possibility that the case of large fibrosarcoma of the abdomen treated by Skinner, of New Haven, may prove the single exception to the rule of recurrence after X-ray treatment. The history of this case is so remarkable that it merits a brief *résumé*.

M G H, female, thirty-four years old, was referred to me by Dr Maurice H Richardson, of Boston, on April 19, 1901. She had been operated upon three years before for what was supposed to be a fibro-adenoma of the uterus, tubes and ovaries were removed. No microscopical examination was made. Two months prior to her coming to me, she had noticed a large tumor in the lower part of the abdomen in the region of the cicatrix. Physical examination at that time showed a tumor the size of a cocoanut in the lower part of the abdomen, filling up the entire iliac fossa extending nearly to the umbilicus, two inches beyond the median line to the left. The tumor was firmly fixed and seemed to involve the abdominal wall. An incision was made under cocaine, and a portion of the growth, which infil-

trated all the muscles of the abdominal wall, was removed, and on microscopical examination proved to be fibrosarcoma I used the erysipelas and *Bacillus prodigiosus* toxins more or less constantly until January, 1902, at first with marked diminution in the size of the tumor, but later with very little effect, and, finally, the tumor began to grow in size very rapidly I regarded the case as entirely hopeless The patient had lost much weight and had begun to be cachectic The X-ray treatment was begun by Dr Clarence E Skinner, of New Haven, on January 28, 1902 Forty-six applications were given up to June 5, by which time the lateral circumference of the tumor had increased from thirteen and three-quarters to fifteen inches She had had several attacks of fever lasting for a few days, with symptoms of toxæmia, probably from absorption Her general health, however, improved considerably during this time From June to September she received thirty-one treatments, and during this time there was so much local and general improvement that she decided to resume her work as a school-teacher Up to April 25, 1903, or 234 days, she received forty-six treatments, or about one treatment in five days There was a marked decrease in the size of the tumor From April 25 to August 29, 1903, she received only eight treatments, or one every two weeks She had gained eleven pounds since the beginning of the treatment From August, 1903, till May 20, 1904, she received only five treatments, or one every thirty-seven days By this time her weight had increased to 147 pounds, being nineteen pounds more than in the beginning, and the tumor had entirely disappeared In July, 1904, I examined the patient and was unable to detect any evidence of a tumor The entire period of treatment extended over 849 days, during which time 136 treatments were given

While it is true that only one year has elapsed since the cessation of the treatment and disappearance of the tumor, it is nevertheless the most remarkable case on record, I think, considering the very large size of the growth and its deep-seated location, although, of course, it is quite too soon to consider it a cure

In a letter dated June 4, 1905, the patient states that she is in perfect health, and has had no return of the tumor

In the last report of the Caroline Brewer Croft Cancer Commission of the Harvard Medical School, Vose and Howe present a careful *résumé* of the effects of the X-ray upon cancer, their investigations being based upon a study of 120 cases treated chiefly at the Massachusetts General Hospital of Boston

In regard to deep-seated cancer, they fail to report a single case, carcinoma or sarcoma, that has thus far disappeared. They conclude that, being non-selective in its action, the X-ray cannot be used strongly enough to effect destruction in anything but the shallowest tumor without serious injury to the overlying tissue, or, in other words, producing such a burn as experience shows in all probability would never heal.

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Of late the use of the X-ray as a pre-operative measure has been strongly advocated by a number of men, especially by Dr Morton, of New York. It is held that in cases of cancer in the early stages, particularly in small primary cancer of the breast, instead of advising immediate surgical intervention, the patient had better first be treated by the X-ray. The reasons for this plan are (1) that the X-ray treatment clears up the field of operation, *i e*, causing the glands in the axilla to subside or disappear and making the tumor itself smaller. If, at the end of four to five weeks of treatment, the growth has not entirely disappeared, an operation can then be performed, and performed under more favorable conditions than if the X-ray treatment had not first been used.

This plan of procedure I believe to be most pernicious and fraught with grave peril to the patient, if it should ever be considered seriously by the profession. The fallacy of such reasoning is twofold. (1) it presupposes that we are dealing

with a curative agent, and (2) it takes for granted that no harm can come to the patient by reason of the delay entailed in a trial with the treatment

Now let us look at the facts Has it yet been demonstrated that the X-ray is curative of cancer in any other form than the small superficial epitheliomas? As far as our own experience goes, extending over a series of 167 cases, and as far as can be judged from the published reports of the work of other men, there have been very few cases of deep-seated cancer, including sarcoma, that have disappeared under X-ray treatment, and there is at the present time no evidence that in a single case of deep-seated cancer in which the tumor disappeared, the patient remained well and free from a local or general return for a period of three years, the shortest time required to warrant us in speaking of a cure On the other hand, we do know from experience that in practically all of the cases in which tumors have disappeared there has been a speedy recurrence

This to prove that we are dealing with an agent that has given us no reason, so far, to call curative

(2) The danger of postponing operative treatment until the X-ray has been tried is lost sight of I have personally seen a number of cases of primary or recurrent cancer of the breast markedly decrease in size under X-ray treatment and, in some instances, altogether disappear at the very time when the disease was insidiously extending into neighboring glandular areas, the cervical or mediastinal glands, or was being carried by the circulation into the general system, giving rise to fatal metastases In these cases the extension was so rapid that I believe the breaking down of the tumor tissue, which occurs before absorption takes place, carries with it the serious risk of some of the living cells getting into the circulation, thereby causing generalization of the disease The experiments upon cancer in mice carried on by Drs Park, Gaylord, and Clowes at the Cancer Research Laboratory in Buffalo tend to support this opinion

The prolonged use of the X-rays in cases of recurrent

cancer of the breast, as well as in a number of cases of recurrent cancer of the tongue and lip, has shown practically little or no effect upon the invaded glands, they neither disappeared nor decreased materially in size

Now suppose the X-ray treatment were tried for a few weeks before operation. Three things may occur

1 The diagnosis may be quite uncertain without removal and microscopical examination of the tissue, hence, the result, if the tumor disappears and the patient remains without further trouble, cannot be put in the same category as a cure from operative treatment, in which the diagnosis has been confirmed by the microscope

2 Granting the correctness of the diagnosis and the tumor disappears under the treatment, such a result, while possible, from our present experience, is extremely unlikely to occur. Of forty-three cases of malignant tumors, even including superficial epitheliomas, reported by Skinner, whose enthusiasm in behalf of X-ray treatment cannot be doubted, only three entirely disappeared, or 7 per cent, and a much smaller percentage would be found if dealing with deep-seated cancer alone. Of my own breast cases, thirty-six in number, only one disappeared, and this was quickly followed by a recurrence and extension into lung

If, however, the tumor should disappear, the patient, believing herself cured, returns to her home, and before any local recurrence has taken place the disease may appear in the axillary, cervical, or mediastinal glands, or there may be metastatic deposits in the lung or liver, thus placing the patient beyond help from either X-ray or surgery

3 Suppose the growth to have diminished in size and then to have shown no further improvement. Such a case is said to be in better condition for operation than before the X-ray treatment. But is such the case? The very fact that the tumor has diminished in size or the glands are smaller would tend to restrict the field of operation and lead the surgeon to remove less tissue than he otherwise would have done. But above and beyond all other considerations, in my

estimation, is the fact that tumor degeneration caused by the X-ray carries with it the risk of living cancer-cells being carried into the neighboring glands and of entering the circulation, causing metastases

The following case which has recently come under my observation, and which can, no doubt, be duplicated by many surgeons, furnishes striking evidence of the dangers to the patient in the pre-operative use of the X-ray in primary operable growths

*Epithelioma of the Lip*—A man, aged fifty years, noticed a small epithelioma of the lip in the spring of 1903, about the size of a small bean. He was advised to have X-ray treatment rather than operation, and after thirteen exposures the tumor had apparently entirely disappeared and the patient was discharged cured. Less than six weeks after this time, a local recurrence was noticed, when again the X-ray treatment was taken up. At this time the X-rays had apparently no effect upon the growth of the tumor, which continued to increase in size rapidly in spite of frequent treatments, and, finally, three months later he was sent to me for operation. His condition at this time was as follows: There was a typical ulcerating epithelioma involving more than half of the lower lip, and, in addition, the sublingual and submaxillary glands were extensively involved. I performed a very extensive operation, removing three-quarters of the lower lip and the glands as carefully as possible, but with little hope of radical cure. About six months later there was a recurrence in the cervical glands.

When we consider that epithelioma of the lip in its earlier stages furnishes the largest percentage of cures of any locality, about 50 per cent, it is fair to infer that in this case the patient's life was probably sacrificed owing to the loss of time incurred by the pre-operative use of the X-ray.

I have recently examined a man aged sixty years, who, about a year ago, was treated with the X-ray for a small epithelioma of the tongue, receiving fifty-two treatments in all, with the result that the disease now involves the entire

anterior half of the tongue, floor of mouth, submaxillary and sublingual glands, the growth being firmly adherent to the bone

### CONCLUSIONS

The results of the X-ray treatment of malignant tumors up to the present time have proven

I That the X-ray exerts a powerful influence upon cancer cells of all varieties, but most marked in cases of cutaneous cancer

II In some cases, chiefly in superficial epithelioma, the entire tumor may disappear, probably by reason of fatty degeneration of the tumor cells with subsequent absorption

III In a much smaller number of cases of deep-seated tumors, chiefly cancer of the breast and glandular sarcoma, tumors have disappeared under prolonged X-ray treatment. In nearly every one of these cases, however, that has been carefully traced to final result, there has been a local or general return of the disease within a few months to two years

IV In view of this practically constant tendency to early recurrence, furthermore, in the absence of any reported cases well beyond three years, the method should never be used except in inoperable cases, or as a prophylactic after operation, as a possible, though not yet proven, means of avoiding recurrence

V The use of the X-ray as a pre-operative measure in other than cutaneous cancer is contraindicated, 1, because the agent has not yet been proven to be curative, 2, because of serious risks of an extension of the disease to inaccessible glands or to other regions by metastases during the period required for a trial of the X-ray

# SCOPOLAMINE-MORPHINE AS AN ADJUVANT IN THE ADMINISTRATION OF GENERAL ANÆSTHESIA.<sup>1</sup>

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THE purpose of this paper is to present a series of sixty-five general anæsthesia administrations, showing that the method used is one that merits recommendation and trial. This series included the following range of cases: Abdominal Hysterectomy, 8, Vaginal Hysterectomy, 6, Herniæ, 5, Plastic Operations, 8, Operations in the Tubes and Ovaries, 11, Uterine Fixations, 6, Curettements, 6, Hæmorrhoids, 3, Fistula in Ano, 2, Thyroidectomy, Craniectomy, Orchidectomy, Appendicectomy, Costectomy, Nephropexy, Tumor of Breast, Cyst of Neck, Pelvic Abscess, Exploratory Laparotomy, one each. In every instance the patient received a hypodermic injection of scopolamine hydrobromate, grain 1/100, and morphine, grain 1/6, one half-hour before the administration of the general anæsthetic. The general anæsthesia was induced by means of the ethyl chloride-ether sequence administered through the Bennett inhaler.

The Bennett inhaler was used because an experience of five years with it has assured the writer of its practicability, and because he finds disadvantages in all other inhalers. In the recently described inhaler of Iglauer,<sup>1</sup> for example, the anæsthetist is unable to administer ether or gas at will, after once having started the administration of ether. Ethyl chloride is substituted for nitrous oxide gas, because it is practically as safe, induces quicker anæsthesia, causes no cyanosis or asphyctic symptoms, and obviates the necessity of transporting bulky

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<sup>1</sup> Read before the Medical Society of the City Hospital Alumni of St Louis, May 18, 1905



steel cylinders of the compressed nitrous oxide gas Herrenknecht,<sup>2</sup> in a most extensive monograph, confirms the above statements Gaudiana<sup>3</sup> reaches the same conclusions, and shows that not one of the few instances of death laid at the door of ethyl chloride was solely due to the drug itself Danill,<sup>4</sup> the instructor in anæsthetics at the Royal Infirmary, says of the ethyl chloride-ether sequence, "the method certainly has some advantages over the gas-ether sequence, and is a most excellent one I have never had reason to complain of it, either from the point of view of safety or for any other reason The advantages of the ethyl chloride-ether sequence are practical ones"

In order to make the Bennett inhaler suitable for the administration of ethyl chloride, a slight modification was necessary A piece of small-caliber brass tubing (length 3 centimetres, lumen 15 millimetres) was inserted about one-half an inch distally to the air-valve This brass tubing is placed obliquely, so as to throw the ethyl chloride spray towards the rubber bag of the inhaler, thus insuring against any of the fluid reaching the patient's face By means of a three or four inch piece of rubber tubing, a connection is made between the ethyl chloride container and the inhaler, through the brass tube These details show clearly in the appended illustrations As the ethyl chloride container hangs suspended from the brass tube, the rubber tube kinks and effectively shuts off the escape of any ethyl chloride gas By one movement the flask of ethyl chloride is turned spout end down, and the rubber tube straightened out, so that a measured quantity of the fluid runs into the rubber bag There is no frosting or freezing, and consequently no more chance for the much talked of "refrigeration of the lung" than there is with any other anæsthetic The method really simplifies the Bennett inhaler, in that it does away with the large and cumbersome gas-bag In this very simplicity the modification seems to possess a decided advantage over the more complicated one recommended by Pedersen<sup>5</sup>

At this day there is certainly no occasion for a statement

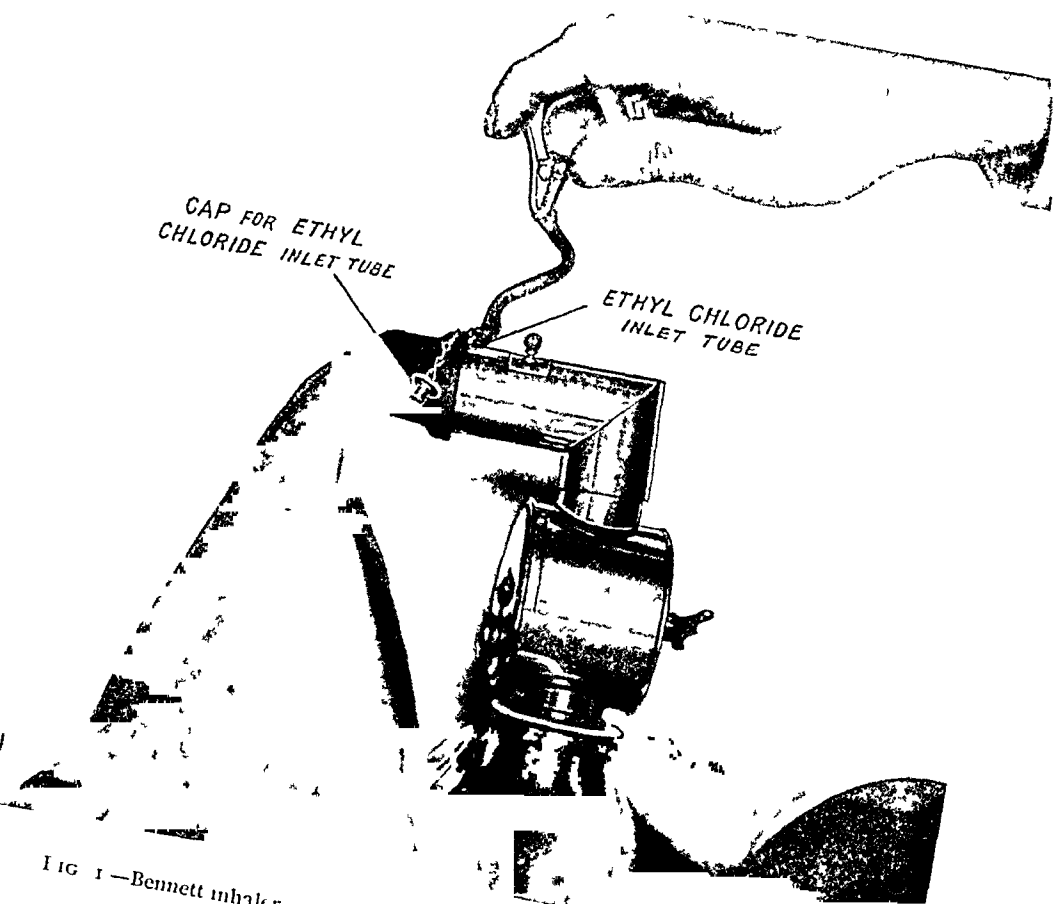


FIG 1 —Bennett inhaler modified for the use of the ethyl chloride ether sequence



of facts justifying the use of ether as a routine general anæsthetic. It has been shown repeatedly during the last few years that the formerly much dreaded "postoperative pneumonia" is by no means solely referable to ether. Aspiration of mucus and vomitus, exposure, and pulmonary embolism have been pretty clearly demonstrated to be the predisposing factors of postoperative pneumonias, and no particular anæsthetic, not even local anæsthesia, does away with the danger of exposure, of embolism, or of vomiting. Moreover, experimental proof is gradually accumulating to show that ether is not the only anæsthetic that has an injurious effect on the kidneys. Kemp<sup>6</sup> showed, as early as 1899, that "renal complications may follow *any* anæsthetic, for there is no known anæsthetic administered in any effective quantity, whatever the method of administration, which does not affect the renal circulation." Moreover, M. Jaquet,<sup>7</sup> in a comprehensive investigation of the comparative merits of chloroform and ether, shows that chloroform causes a parenchymatous degeneration of all the organs, whereas, ether produces no histological lesions, and this fact has been confirmed in a lately published research of Offergeld.<sup>8</sup> The latter author even shows that the parenchymatous degeneration induced by chloroform may be the cause of death some time after the administration of the anæsthetic.

Unfortunately, the physiology of artificially induced anæsthesia is not positively known. The important conclusions worked out by Overton<sup>9</sup> are generally credited as being correct, and are already finding their place in standard works on physiology. For the clinician, the important aspect of Overton's work is not so much the establishment of the doctrine that anæsthetics act by going into solution in the lipoids (fat, cholesterol, and lecithin) of cells, as the other fact, that the injury wrought in these cells is directly proportional to the quantity of anæsthetic used. It is probably fair to assume that not one operator in a hundred concerns himself with the quantity of anæsthetic administered to his patient. Yet we read in one of the latest published works on physiology<sup>10</sup>

that "cell death is caused by a prolonged anæsthesia" One of the ends to be aimed at in the administration of all the anæsthetics is to reduce the amount administered to a minimum The ethyl chloride-ether sequence most positively aids us in the attainment of this end

We are further aided, however, by the administration of scopolamine-morphine hypodermatically Scopolamine is an alkaloid of *hyoscyamus niger* of the order of solanaceæ Its sister alkaloids are hyoscine, daturine, duboisine, atropine, and hyoscyamine Although much has been written concerning scopolamine (chiefly as a result of the investigations of psychiatrists and chemists), it still remains to be settled in just what particulars it differs from other alkaloids of the belladonna group It is most closely related to hyoscine Kunzel,<sup>11</sup> Steinbuechel,<sup>12</sup> Kochmann,<sup>13</sup> and others state that it is identical with hyoscine, whereas Ladenburg<sup>14</sup> claims to have shown that hyoscine and scopolamine are by no means identical The best *résumé* of the physiological action of scopolamine is given by Steinbuechel<sup>12</sup> He states

1 Small doses *raise* blood-pressure by stimulating the vasomotor centre Large doses lower it by influencing the cardiac excitomotor mechanism

2 Pulse usually slowed a trifle, but is ordinarily not influenced by small doses Large doses cause a *vagus* pulse

3 Cerebral cortex rendered less excitable when stimulated by the faradic current Sleep is induced, but not analgesia

4 Respiration not influenced by small doses Large doses slow respiration

5 Sweat, mucus, and saliva secretion markedly diminished

6 Mydriasis

7 Motor end-apparatus supplying the intestine paralyzed  
Tone of the splanchnic increased

8 Excreted by the kidney

Kochmann<sup>13</sup> states that there has never been a death attributable to scopolamine Dogs react to the drug exactly

as do human beings, yet a dose of thirty grains, injected intravenously into a fifteen pound dog, does not kill

In 1900, Schneiderlin<sup>15</sup> published the first paper advocating the use of scopolamine as a substitute for general anæsthesia by inhalation. Scopolamine itself does not induce analgesia, but combined with morphine it induces a state of general anæsthesia sufficiently profound to permit the performance of any operation. The method of administration and dosage was more carefully worked out by Korff<sup>16</sup> and Bloss,<sup>17</sup> as a result of Korff's work, in particular, the following dosage was adopted. Scopolamine, 0.0012, and morphine, 0.025. This was divided into three doses, administered hypodermatically, three, one, and one-half hours before the operation. Schneiderlin, Korff,<sup>18</sup> and Bloss all reported excellent results.

Rational objections were gradually advanced against a method of inducing anæsthesia by means of fixed dosage, one author even going so far as to pronounce the method useless and dangerous.<sup>19</sup> In addition, three unfortunate deaths occurred during and following operations on patients to whom scopolamine and morphine had been administered. These deaths, although not wholly referable to the anæsthesia, nevertheless served to place scopolamine-morphine narcosis in discredit. There it remained until Carl Hartog<sup>20</sup> suggested that both the scopolamine and morphine be administered in much smaller doses than was recommended by previous authors, and that ether be relied upon to complete the anæsthesia. Hartog reported seventy-five cases, and spoke of his results in most glowing terms. It was my good fortune to observe most of the cases he reported, and to be able to confirm all his statements.

Through the kindness of Drs. Gellhorn, Ehrenfest, Witherspoon, Bartlett, and Mudd, I am able to report a series of sixty-five cases in which scopolamine hydrobromate, grain 1/100, and morphine, grain 1/6, were administered half an hour before inducing general anæsthesia with ethyl chloride-ether. In more than half the cases the anæsthetic was admin-

istered by Dr W E Leighton As a result of my experience with the method, I feel that I may say without reserve that I have never seen results even approximating those that were obtained by this method Unstinted praise always carries with it the suspicion of a somewhat biased critique Yet, so exceptionally smooth were these narcoses that they warrant one's carrying the burden of this suspicion until it is proved unfounded Of these sixty-five cases only one vomited or retched while on the operating table Seventy-seven per cent of the cases *did not vomit at all* One-third of the cases that did vomit, vomited only once, and then only from two drachms to one ounce of clear mucus Nausea was never pronounced, except in two cases, and vomiting never occurred earlier than two hours after the operation This last fact is of supreme importance, for in all cases where vomiting did occur, laryngeal sensibility was intact, and acted as a complete safeguard against tracheal aspiration, and the consequent danger of an aspiration pneumonia There is no occasion for dilating upon either the discomforts or the dangers attendant upon post-anæsthetic vomiting They are well known I can find no record of a series of general anæsthesia administrations followed even by approximately so small a percentage of vomiting, and if the preliminary administration of scopolamine-morphine did nothing else than lessen the liability to vomit, its use should be highly recommended

But it does more First of all, it markedly lessens the quantity of anæsthetic necessary About four ounces of ether per hour of operation are used when the drug is administered skilfully and carefully In a personal communication to me, Dr T L Bennett, of New York, tells me that he uses about four ounces of ether per sixty minutes of anæsthesia, and that for a two-hour operation he requires about six ounces This averages three and a third ounces per hour We used barely a fraction over two ounces an hour It has already been pointed out how great a desideratum it is to administer a minimal quantity of ether

After the administration of scopolamine-morphine the

patients are in a peaceful state of mind, and go under the influence of the general anæsthetic without passing through the usual state of excitement. Salivation is almost invariably absent, thus adding another safeguard against aspiration pneumonia. After their return to bed the patients lie absolutely quiet and awaken without the slightest excitation. After remaining awake for a short period they usually doze off again, or at least remain quiet and peaceful. The first twenty-four hours following the operation is attended by much less pain and discomfort than in cases where the scopolamine is not administered. These advantages—lessened amount of anæsthetic necessary, absence of salivation, avoidance of the stage of excitement, marked reduction in the liability to vomit, and quiet and freedom from pain after operation have been confirmed by Tuffier,<sup>21</sup> of Paris, Israel<sup>22</sup> and Dork,<sup>23</sup> of Berlin, and by Robertson,<sup>24</sup> of our own country (Robertson used hyoscine instead of scopolamine).

There is no reasonable objection to the use of scopolamine hydrobromate and morphine in the doses recommended of 1/100 and 1/6 of a grain respectively. The recent experimental work of Crile<sup>25</sup> shows that morphine lessens the intensity of many of the afferent nerve impulses reaching the vasomotor centres, as the result of stimulation of the peripheral nerves, and thereby lessens the susceptibility to shock. Scopolamine exerts a distinct influence in raising blood-pressure, and thereby also aids in preventing shock. So, from the point of view of prophylaxis, the combination of the two drugs strongly recommends itself. Only he who has witnessed a series of ether administrations preceded by scopolamine-morphine injections can appreciate what a boon these drugs afford both to the patient and to the operator.\*

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\* It must be added that the consensus of opinion is, that many of the irregularities in the action of scopolamine are referable to impure preparations of the drug. All the authors quoted are in accord that Merck's scopolamine is the most reliable preparation. Moreover, scopolamine hydrobromate does not keep well in solution, and, in order to avoid the constant preparation of fresh solutions, I have had Parke, Davis, and Company make up tablet triturates of Merck's scopolamine.



hydrobromate in tablets of  $\frac{1}{100}$  grains each One of these tablets should be dissolved together with a one-sixth grain tablet of morphine and injected hypodermically thirty minutes before the administration of the general anæsthetic Scopolamine may be used with advantage as an adjuvant to chloroform, as well as to ether

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# SCOPOLAMINE-MORPHINE ANÆSTHESIA.

## REPORT ON ITS USE IN SEVENTY-TWO CASES

BY EMIL RIES, M D,  
OF CHICAGO

IN May, 1900, Schneiderlin<sup>1</sup> first published his experience with a new method of general anæsthesia produced by the aid of a combination of scopolamine and morphine. Since then a number of reports have been published in Germany and Austria, but I am not aware that anybody has used the method to any extent in this country, or has given a report on it in the literature. As the method undoubtedly has great advantages, it will probably come into more extended use, and some words concerning my experience with it might prove of value to others who may wish to test it.

Scopolamine is an alkaloid extracted from the roots of *scopolamina carniolica*. It is closely related to hyoscine. According to some authors hyoscine and scopolamine are identical, or at least isomeric, while others state that hyoscine always contains scopolamine and is not a pure alkaloid.

However that may be, it is pretty certain that scopolamine, though it is produced and sold in crystals, is unstable and not absolutely uniform in its composition.

Kochmann<sup>2</sup> states the following effects of scopolamine which interest us here:

- 1 Small doses increase the blood-pressure in consequence of irritation of the vasomotor centre, large doses decrease blood-pressure considerably, damaging the excitomotor apparatus of the heart.

- 2 The pulse is not changed by small doses, after large doses, in consequence of irritation of the vagus, the pulse becomes less frequent and its elevations become greater.

- 3 The excitability of the cortex of the brain by faradic currents can be decreased by scopolamine.

4 Hyoscine and scopolamine produce in man sleep, even in small doses The sleep is preceded by restlessness Analgesia during the sleep does not exist

5 Respiration is not damaged by therapeutic doses Large doses damage it

6 Secretion of saliva, perspiration, and mucus are stopped by scopolamine

7 Applied locally, and after absorption, scopolamine is a mydriatic and paralyzes accommodation

8 Scopolamine is excreted through the kidneys

9 The fatal dose of scopolamine is unknown Injection of 0.09 scopolamine intravenously did not produce death in a dog

Schneiderlin, like other alienists, had used scopolamine in his work in an insane asylum for the production of sleep in restless patients, and had then combined it with morphine in order to produce surgical anæsthesia for operations necessary on his demented patients He expected to counteract the evil effects of morphine, particularly with regard to blood-pressure and pulse, by combining scopolamine with morphine, and his theoretical construction proved successful in his practice

The greatest difficulty has since been found in determining the best proportion of the two drugs If too much morphine is given, the effect on the heart becomes dangerous If too much scopolamine is given, a state of excitement is produced similar to that following atropine poisoning The patients become restless It is difficult to keep them quiet They talk as if in a delirium The pupils are widely dilated and rigid, and the face is flushed The patients demand water constantly and complain of dryness, but the excitement soon wears off, and neither in man nor in dogs have any cases become known where scopolamine alone has produced death I have experimented on a dog of some eight pounds, to whom I gave fifteen times the dose we use on human beings, and, if I figure pound for pound, 225 times the dose we use on human adults of average weight, and it did not affect the dog's health at all

In dosage and proportion, I have followed Korff,<sup>3</sup> who

published his experience with 200 cases. He gives one-tenth milligramme scopolamine and 25 milligrammes of morphine. This amount is divided in three doses, which are injected two and a half, one and a half, and one-half hour before the operation. He states that these doses are without danger, but that their effect varies in different individuals. The injection is given hypodermically in any part of the body. He thinks that if this dose does not suffice, larger doses ought not to be given, but chloroform or ether should then be used.

It is seen, therefore, that scopolamine-morphine is used for two purposes: first, with the intention to perform the whole operation under this anæsthesia alone, secondly, as a preliminary to anæsthesia by inhalation of chloroform or ether.

If the case is a complete success, the patient becomes sleepy after the first injection, is fast asleep after the second, and unconscious and insensible to pain after the third. Most of the patients do not even feel the third injection. The operation may then begin one-half hour after the last injection, and can proceed for hours without any other anæsthetic. The patients lie on the table with eyes closed or open, and do not move or react in any way. The pulse is often rapid, up to 120, sometimes very slow, down to 40. Respiration is quiet, and there is none of that disagreeable and dangerous accumulation of mucus in the mouth. The pupil is rigid, either dilated or contracted. The muscles are relaxed. The blood which escapes during the operation is of natural color. After the operation is finished, the patient is returned to the bed still unconscious, and continues to sleep for about five hours after the last injection. There is no retching or vomiting, and when the patient wakes up, food can be given immediately. For about one day the patient has a sensation of dryness in his mouth. There is no interference with the union of the wound or the peristaltic action of the bowels. The patient remembers nothing of the operation, goes to sleep in his bed, and wakes up usually unconscious of the fact that he has been operated on, and incredulous when he is informed that it is all over.

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Thus the ideal course of a scopolamine-morphine anaesthesia. If they were all like that there would be no further need of discussions. But this ideal course partakes of the nature of all ideals in that it is frequently unattainable.

It is true that all patients whom I have seen go to sleep after the injection, but that sleep may be such a light one that they wake up when spoken to or moved, so that no manipulation is possible without rousing the patient. Some patients, even if aroused, cannot answer intelligently, but mumble a few unconnected words. Others wake up sufficiently to give correct answers. Others again, though they cannot be roused, move when being handled, or even complain.

Then it becomes necessary to add some other anaesthetic to the scopolamine-morphine. Ether and chloroform have been used by the European operators, and I have added infiltration anaesthesia with 0.6 per cent salt solution without cocaine, which I have used in a number of cases successfully to the complete exclusion of chloroform. When chloroform is administered, very small quantities have to be used, and in many cases after the first few drops have been given, for the first incision, no more chloroform need be used, so that operations lasting fifteen or thirty minutes can be finished with less than a teaspoonful of chloroform. When the patients are not completely anaesthetized by the scopolamine-morphine, the same observation can be made as when operating without any or only with infiltration anaesthesia. Some organs are sensitive, some are not, some more so than others. The relaxation of the muscles may be more or less complete. While Korff<sup>3</sup> reports that he could reduce a dislocation of the shoulder with scopolamine-morphine alone, others emphasize, and that is my experience also, that scopolamine-morphine does not, as a rule, produce complete relaxation of the muscles, so that, for instance, in certain abdominal sections, where the recti muscles have to be held apart, it is necessary to add chloroform to the scopolamine-morphine.

It is noteworthy that even when chloroform has to be added to scopolamine-morphine, the latter still proves of great

value First, there is no or hardly any excitement Secondly, very little chloroform is needed, as stated above Thirdly, the vomiting is very much reduced or entirely absent Fourthly, the patients sleep for hours after the operation, and get over the disagreeable postoperative stage without any disturbance Complete amnesia of everything connected with the operation, from the time the second dose of scopolamine-morphine has been given, is generally observed, so that even patients who appear wide awake, or who resist now and then during the operation, do not remember anything about it, or even refuse positively to believe that the operation is finished

Scopolamine-morphine has been used in a wide range of operations I have used it myself so far on seventy-two patients in ninety-two operations The following is a list of the operations performed The number of operations is greater than that of the patients, because in a number of cases several operations were performed at the same time, for instance, appendectomy and femoral hernia, cholecystostomy and nephropexy, plastic operation on the vagina, curettement and ovariectomy, etc

Amputation of breast, 1, amputation of thigh, 1, appendectomy, 12, appendiceal abscess, 2, cholecystostomy, 1, colostomy, 1, curettement, 8, cystoscopy, 3, extirpation of carcinoma recti, 1, extirpation of carcinoma uteri, 1, extirpation of goitre, 3, extirpation of testicle, 1, extirpation of tubercular glands, 2, extirpation of tumor of chest wall, 1, extirpation of urethral caruncle, 1, operation for stenosis of cervix, 1, hæmorrhoids, 6, abdominal hysterectomy, 5, vaginal hysterectomy, 3, laparotomy for pus-tubes, 2, nephropexy, 1, nephrotomy, 1, plastic operations on vagina, 14, prostatectomy, 1, radical operation for ventral hernia, 2, for inguinal hernia, 10, for femoral hernia, 1, vaginal celiotomy, 3, vaginal ovariectomy, 1, varicose veins of leg, 1, ventrofixation, 1, total, 92

Of these seventy-two cases, three have died A carcinoma of the uterus died from hæmorrhage due to laceration of the iliac vein in dissecting off adherent enlarged lymphatic glands

The case of carcinoma of the rectum, in which the affected portion of the rectum was torn into during the operation, died of peritonitis five days after the operation. The case of prostatectomy, a very bad case of an old man in a septic condition, who was very anæmic in consequence of repeated severe vesical hæmorrhages and who had the largest prostate I have ever seen (much larger than a fist), died some six hours after the operation. In none of these cases can I accuse the scopolamine-morphine.

In the literature on scopolamine-morphine, a number of deaths have been reported as due to the scopolamine-morphine, but it seems to me with very little justification. The only case that seems to be due possibly to the scopolamine-morphine is one reported by Flatau,<sup>4</sup> in which, after an easy and uneventful operation on a submucous fibroid, the patient, who was exsanguinated by previous hæmorrhages, succumbed six hours afterwards. Her pulse grew weaker and weaker, became intermittent, Cheyne-Stokes respiration was observed. Post-mortem was not performed.

In all the other cases that have been reported, it seems to me entirely unjustified to accuse the scopolamine-morphine.

A number of these fatal cases may have been due to the large doses of morphine which Bloss<sup>6</sup> had recommended, but which I have never used. Favorable reports are given by Volkman<sup>7</sup> on 20 cases, Bonheim<sup>8</sup> on 70 cases, Wiesinger<sup>9</sup> on 200 cases, Hartog<sup>10</sup> on 143 cases, Grevsen<sup>11</sup> on 69 cases, Semmon<sup>12</sup> on 52 cases, a total of 554 cases.

In only two cases have I given a dose of morphine larger than above indicated. In one case a patient on whom I had operated for a large goitre with scopolamine-morphine was operated on a week later for a large ventral hernia. While the first time she had slept through the whole operation, she was not completely asleep before the second operation, and I gave her an additional 0.015 morphine. The operation was then completed without any chloroform. It lasted sixty-five minutes, and towards the end the patient was sufficiently awake to talk with her friends, and did not interfere with the operation in any way. In another case, in a very big woman with endo-

metritis and descensus of the vagina, the patient also was not completely asleep before the operation, and I gave her an additional 0.015 morphine. But the patient, though asleep during the operation, moved her legs repeatedly, so that we added 9 cubic centimetres of chloroform for the operation, which lasted thirty minutes. In both cases the pupil, before the extra amount of morphine had been given, was dilated, showing a preponderance of the scopolamine, and I therefore risked the additional amount of morphine.

The effect of hyoscine is so much like that of scopolamine, that my first cases on which I operated with hyoscine before I obtained the scopolamine, have had exactly the same course as those operated on with scopolamine. And excision of a urethral caruncle, a vaginal hysterectomy, a radical operation for inguinal hernia were performed without a drop of chloroform, and such operations as appendectomy, ventrofixation, and excision of hæmorrhoids on one patient, radical operation for unilateral or bilateral inguinal hernia on a second and third, appendectomy on a fourth, vaginal radical operation for double pyosalpinx on a fifth, vaginal plastic on a sixth patient were performed with such small quantities of chloroform as 9, 15, 5, 5, 25, 6 cubic centimetres of chloroform respectively.

It has repeatedly been noticed that hysterical patients or patients very much afraid of the operations would respond less completely to the scopolamine-morphine as well as hyoscine morphine. Bloss,<sup>6</sup> in fact, goes so far as to say that hysterical patients usually become excited under the scopolamine-morphine. This, however, has not been the general rule in my cases.

The amount of chloroform necessary depends not only on the patient, and his reaction to the scopolamine-morphine, but, and not the least, on the anæsthetizer. Our interne, Dr. Fulton, who has watched the anæsthetic in the cases reported here, has become so expert in the use of chloroform that a very few drops of chloroform, 1 to 5 cubic centimetres, suffice now where at first 15 to 25 cubic centimetres would be necessary. The educational value of scopolamine-morphine in teaching econ-



omy in anæsthetics is, I think, not the least important point in its favor

Scopolamine, when dissolved in water, does not keep long, and it has been our rule to have a new solution made every week. It has repeatedly been noticed that the effect of the scopolamine would decrease towards the end of the week. In the future, we shall have a new solution made every three days. We have always injected the scopolamine and morphine mixed together. I do not know as yet whether the effect of scopolamine-morphine injected separately, even if at the same time, will be different. Experiments in this direction are now under way.

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# HYPERTROPHIC PYLORIC STENOSIS IN THE INFANT.

BY J M'GREGOR ROBERTSON, M.D.,  
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THE following case affords material for a critical consideration of several points of great significance in the evolution of the clinical history of pyloric stenosis in infants, what is commonly called congenital pyloric stenosis, but the term "congenital" implies a theory, and would be better discarded

The child was the first-born of its parents, two young people who had always enjoyed excellent health. The child was born at full time, was of the average size, and in all respects was a plump, healthy-looking infant, a male. It was nursed by the mother, and for the first six weeks thrived exceedingly.

On the day on which he completed his sixth week of age, he began to put up a little now and again after a drink. The vomiting was sudden, and the material was ejected *en masse* with force, sometimes apparently part only of what he had taken, sometimes what seemed the whole, and sometimes there was put up after a meal what seemed the amount of two drinks. Day after day the tendency to put up, after a drink, a portion or all of the meal increased. He was at the time in the country, and I did not see him till ten days after the commencement. He was then still plump and healthy, but he had, his nurse said, lost considerably. At that time there was nothing else she had to note except the persistent ejection after a drink of a portion or all of the milk, always with the same explosive suddenness and force.

I stripped him naked and examined him carefully, and could find nothing of a definite character. To the local practitioner, however, I expressed the opinion that there was a suggestion of three nerve phenomena: (1) A sluggishness of pupils, (2) a faint rigidity of the muscles of the neck, (3) a tendency to turn the eyes downward. The suggestion was so slight that one could not insist on its presence, but later these symptoms became quite distinct.

The child, failing to improve, was brought back to town a

week later, nursing was discontinued, and he was fed by means of a spoon with a milk mixture in very small quantities. At this date he was eight weeks old exactly, he had lost considerably, though he was still not ill-nourished. The temperature in the bowel had been always normal, but on the sixteenth day from the commencement of the vomiting, it reached  $100^{\circ}$  F in the rectum, the pulse was 105 and occasionally intermittent, the respiration was normal, and the pupils reacted slowly to changes of light.

A period followed, occupied by attempts to feed without inducing vomiting, by the use of very small quantities, frequently repeated, of milk mixtures peptonized of various dilutions, Carnrick's food for infants, white of egg in water, etc., being given each a fair trial, and in this way several days passed without much being lost. Thus on the twenty-second day of the illness nothing was vomited for twenty-four hours, twelve ounces of fluid having been given. In the interval between the sixteenth and twenty-second days an effort had been made to substitute rectal for gastric feeding wholly for a period, nothing but water being given by the mouth. But this had to be abandoned, the rectum proving fully as irritable as the stomach, very nearly, indeed quite, intolerant.

During this period, also, an analysis had twice been made of the gastric contents, obtained by the vomit being caught in a clean vessel.

The characters of the vomit were these: an extremely viscid, semigelatinous fluid, white in color, slightly frothy in appearance. It moved like a gelatinous mass in the glass vessel when it was shaken. It was very sour to smell and acid to litmus. The total acidity equalled 17 cubic centimetres decinormal solution to 100 of the filtered contents, and these 17 cubic centimetres were represented as follows:

		Cubic Centimetres
Free HCl	=	0 00
Acid salts	=	10 00
Free organic acid	=	5 00
Organic HCl	=	2 00
		<hr/>
		17 00

A sample obtained a day or two later was so gelatinous that it would not filter. Because of the total absence of free HCl,

a mixture containing 0.2 per cent HCl was given, and under its influence the vomit lost its remarkable viscosity

Dilute peptonized milk seeming to be retained better than other foods, it was resumed in small quantities gradually increased, till two ounces in spoonfuls could be given within half an hour, and this repeated every two hours with little loss. Meanwhile, however, the temperature behaved in an erratic manner. On the twenty-fourth day, for instance, it was as follows: 4 A M, 102°, 8 A M, 102.3°, 12 noon, 100.4°, 6.30 P M, 100.7°, 8 P M, 99.3°. On the following day it was never above normal, and was taken in rectum every four hours.

On the twenty-sixth and following days it was as follows.

Twenty sixth		Twenty-seventh	Twenty-eighth	Twenty-ninth	Thirtieth
4 A M	98.3°	100°	100.3°	99.4°	103.2°
8 A M	103°	98.4°	101.2°	99.4°	103.2°
12 M	101.3°	97.3°	100.3°	100°	101.3°
4 P M	101.2°	98.4°	100.2°	99.2°	99°
8 P M	99.4°	98.4°	98.6°	98.4°	98°
10 P M				102°	

From the sixteenth day of illness to the thirtieth day, the chief facts had been (1) the vomiting of more or less food, sometimes little, sometimes much, occurring from once to three or four times in the twenty-four hours, always with the same explosive force, (2) the erratic temperature, (3) elusive suggestions of nerve symptoms such as already noted. In appearance the child varied in an extraordinary way,—at one time being apathetic, pale, and pinched, with dark rings round the eyes, the eyes themselves dull and listless, with sluggish pupils, at other times he would appear fresh colored and bright, eyes alert, obviously taking notice, pupils freely mobile and expressive. An access of gastric irritability was usually preceded by the child becoming quiet, white, and haggard looking, then would follow the ejection of some food, after which his color and animation might return.

I have already commented on the irritability of rectum which made it impossible to substitute even for a season rectal for gastric feeding. The pharynx was equally irritable. In the course of the period under review repeated examinations were made of

chest and abdomen in general to assure oneself that nothing was being overlooked. If in such an examination any attempt was made with a spoon to depress the tongue, the stomach was immediately evacuated. The pharynx was always clean, but also always hyperæmic. Similarly, palpation over the epigastrium immediately caused vomiting, but up to the thirtieth day of illness no dilatation nor other abnormality had been made out, though repeatedly looked for.

During the whole of this period the child was kept lying on an ordinary single bed, from which he was lifted only for necessary purposes, and he was watched day and night. On the twenty-eighth day he was dull, apathetic, and quiet, his eyes showed a tendency to double external strabismus. His respiration, hitherto regular, assumed a Cheyne-Stokes character, in groups of three or four. The pulse at the time was 134 and the respirations 20 per minute. The rigidity of muscles of the back of the neck was quite obvious.

Towards the end of this period constipation began to be noticeable, what was passed from the bowel containing extremely little fæcal matter and being mainly dark, bile-stained mucus.

On the thirtieth day he was seen by Professor Stockman, when for the first time palpation over the epigastric region failed to induce vomiting. Vomiting had been so inevitable and immediate a sequel of any attempt to palpate the stomach, that as soon as Dr Stockman began to palpate he was spontaneously warned by the mother of what would happen, and when it failed to happen, he was immediately informed by both nurse and mother, without any suggestion of mine, that an attempt to examine in this way had never before failed to provoke evacuation of the stomach. I lay stress upon this point because for the first time also bulging of the stomach was obvious, and for the first and only time gastric peristalsis was visible. In short, only when the stomach failed to empty itself quickly after a meal was there a suggestion of dilatation and of peristalsis, and this was not till the thirtieth day after vomiting had begun, when the child was, in other respects, also failing visibly. On this day, however, no tumor could be felt, but only once had a small quantity been ejected, and that only apparently because of castor oil, while sixteen ounces of fluid had been imbibed.

For a couple of days after this little nourishment was lost,

but a day later—the thirty-third of the illness—I detected on palpation a thickening in the region of the pylorus, and decided to have a surgical opinion. The pylorus could not be felt, the stomach seemed large, but when a No. 10 soft rubber catheter was passed, the stomach was found quite empty but for a little clear, viscid mucus. It was washed out with normal saline, and the returned fluid was quite free from odor, and contained only a plug or two of thick mucus. The child, however, was looking extremely ill, temperature in rectum was  $104^{\circ}$  F, and pulse 148, the surgeon did not think there was the smallest hope of an operation having a successful issue.

The following evening the child had a convulsive seizure, which recurred within an hour, and continued to recur at intervals of an hour and sometimes less for the next twenty-two hours, till operation was performed. The operation was undertaken in response to the request of the mother, who had done a large part of the nursing, had followed with great intelligence the various phases of the illness, and realized how hopeless the situation had become unless surgical interference could find some way of escape.

Contrary to expectation, the child bore the operation without difficulty, and took the chloroform easily, in fact, breathing and pulse improved under it.

The whole gastric wall was found to be uniformly hypertrophied, though dilatation was not marked, and the extreme pyloric thickening made clear the true nature of the disease. A gastro-enterostomy was performed, but under great difficulty, the duodenal wall being extremely thin and the lumen small. The gastric mucosa was very hyperæmic and highly sensitive, the act of introducing a small gauze plug through the wound in the gastric wall inducing a violent pharyngeal reflex, repeated when the gauze was withdrawn. The internal surface of the stomach wall was coated with a thick layer of transparent mucus, of high viscosity, to which I was subsequently disposed to attribute, in part at least, the failure of the operation.

The child survived the operation fourteen hours. Immediately after the operation the temperature stood at  $96^{\circ}$  F in the rectum, but it rose to  $99^{\circ}$  F, and was at  $98.8^{\circ}$  F shortly before death.

Convulsive attacks remained in abeyance for six hours after

operation, but then recurred repeatedly, and death was preceded by a severe one. Vomiting also was frequent in the interval between operation and death. A post-mortem was not permitted, but I was allowed to remove the stomach through the operation wound, and I removed it without disturbing the short circuit.

When a glass tube had been tied into the cardiac end, and the stomach was filled with water, it remained full, apparently not a single drop leaking through the pylorus. The photograph (Fig 1) gives a very accurate view of the appearance of the organ when so distended. Fig 2 shows the stomach opened up longitudinally, and reveals the distribution of the hypertrophy, the extremely narrow channel through the pylorus left patent by the hypertrophy was occluded by the rugæ and the dense secretion, and the outlet the operation meant to provide was similarly obstructed by viscid mucus. The operation, therefore, had secured only a brief relaxation of the extreme irritability of the stomach, but no actual outlet had been obtained. Fig 3 is the photograph ( $\times 6$  diameters) of the hypertrophied pylorus, the hypertrophied portion passing into stomach on the right and duodenum on the left, the mucous surface being uppermost. An X on Fig 2 shows the part from which this section was removed. The section was stained in picrocarmine, and Fig 4 is a drawing of the left hand extremity of Fig 3, where pylorus projects into duodenum.

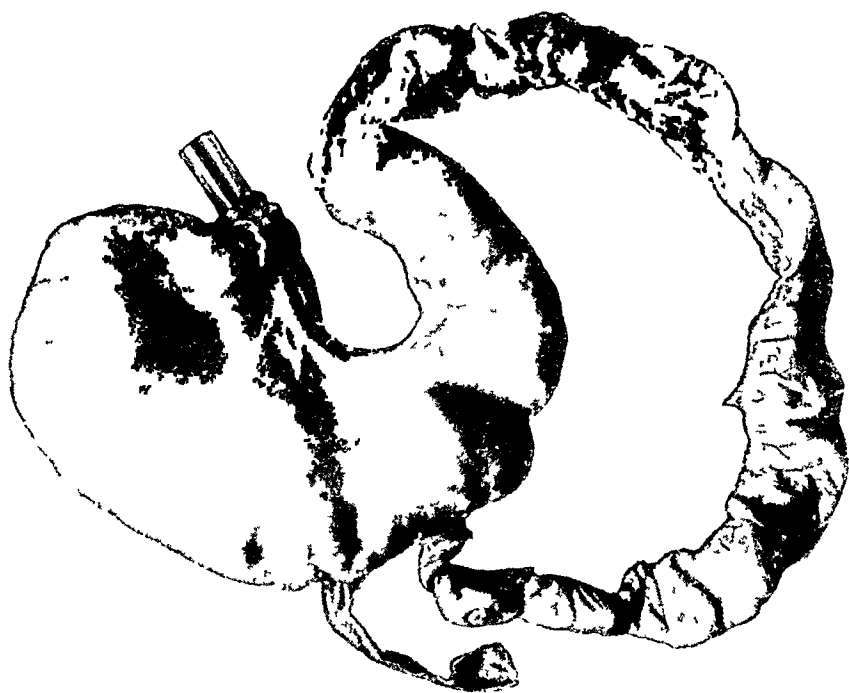


FIG 1—Infantile pyloric stenosis      Appearance of stomach removed post mortem and distended with water





FIG 2—Infantile pyloric stenosis Longitudinal section Congenital section Note hypertrophic thickening of wall of pylorus indicated at X, from which point tissue shown in Figs 3 and 4 was taken

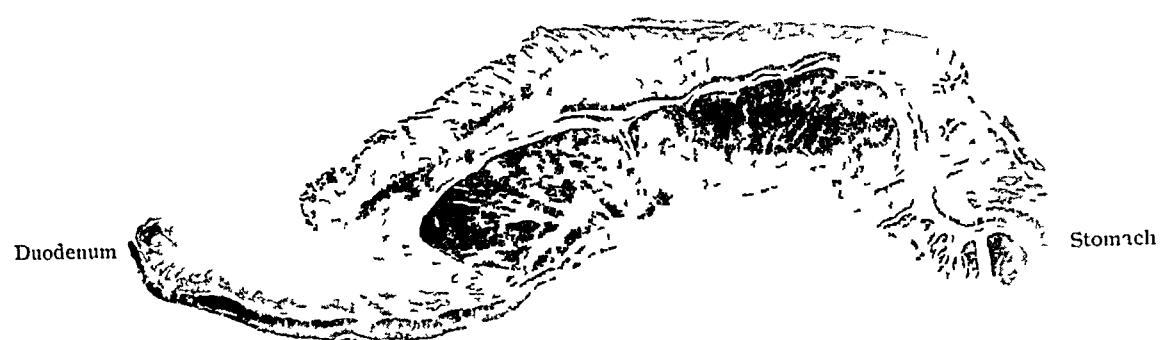


FIG 3—Congenital hypertrophy of wall of pylorus  $\times 6$  diameters

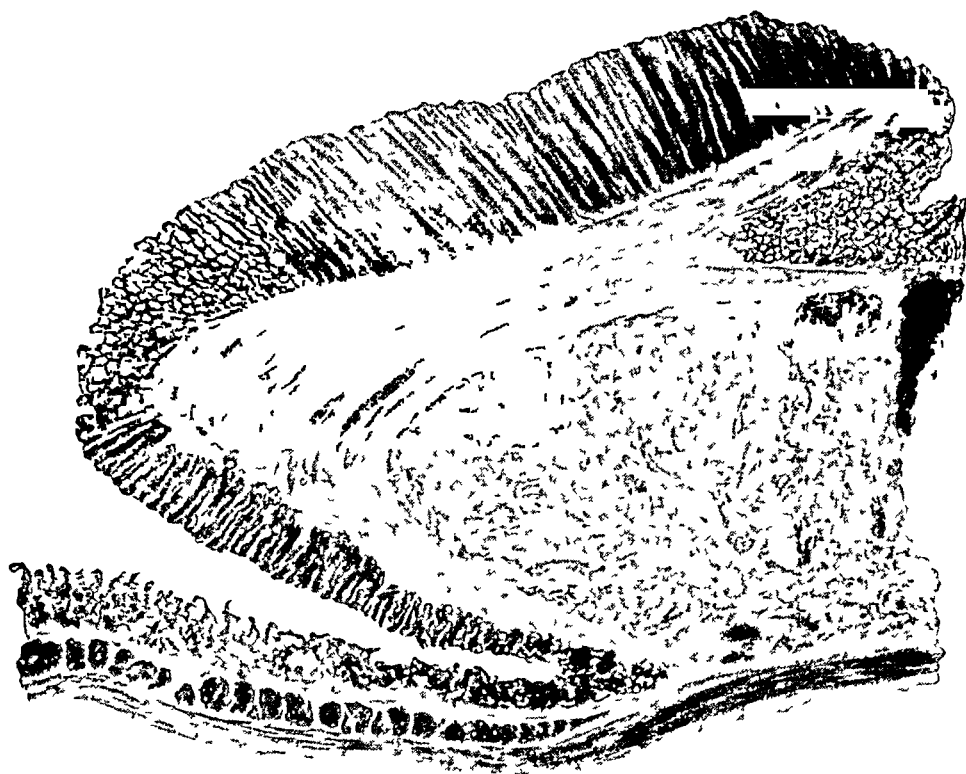


FIG 4 —Gastroduodenal junction  $\times 12$  diameters

# COMBINED VOLVULUS AND HERNIA THROUGH A RECENT MESENTERIC SLIT.

RESECTION OF FIVE AND ONE-HALF FEET OF INTESTINE,  
DEATH ON NINTH DAY.

BY H. C. CURL, M.D.,

Passed Assistant Surgeon, United States Navy, Surgeon, Colon Hospital

A MUSCULAR colored man, aged forty years, was admitted to the Colon Hospital, Isthmian Canal Commission, during the afternoon of March 1, 1905. Patient gave a history of perfect health up to seven o'clock that morning, when he began to have acute abdominal pain, referred to the umbilicus, severe in character, and changing from intermittent to constant. He had been engaged in some light work at the time the pain began, and no history of strain or heavy lifting could be secured. Vomiting had occurred once (about noon), and the bowels had not moved, not even gas passing per rectum. Eructations of gas occurred at infrequent intervals. At 5 P M, when examined, the pain was less severe than it had been earlier in the day, and periods of comparative comfort were experienced, the patient's expression, however, was anxious, and the face was often covered with perspiration. There was no history of errors of diet nor of previous abdominal disease. Temperature, 98° F, pulse, 62, and quite good.

Examination of the abdomen showed slight rigidity of recti, but very little resistance to deep, firm pressure; no tumor and no active peristaltic movements could be felt. The question of operation was considered, but it was decided that the symptoms did not warrant such a procedure at that time. An enema failed to secure more than a very small amount of fecal matter, evidently from the lower bowel, there was no blood. Nothing was given by the mouth and stimulation was secured by hypodermics.

During the night there was moderate pain, and the temperature rose to 99.5° F, pulse, 85. An examination made early the next morning revealed a very different picture from that of

the night before. The abdomen was tense, tender, and resistant, a mass could be plainly felt in the lower right quadrant, and no bowel movement had taken place. The general condition was not good. A "provisional" diagnosis of volvulus having been made, an immediate operation was prepared for. The patient reached the operating table about nine o'clock.

*Operation*—Section was through the right rectus over the mass. On reaching the peritoneum, this was seen to bulge strongly outward, and, on being opened, a jet of foul-smelling, dark fluid spurted from the abdomen. A large knuckle of black intestine lay immediately below the incision, and, after freeing the cavity of fluid, it was delivered. It appeared to be a simple volvulus, and was partially untwisted. There remained, however, a considerable portion of it which could not be so freed, and it was soon discovered that this consisted of a mass of intestine which had forced itself through a recent rent in the mesentery and had become strangulated (Fig 1). As the entire mass was black and without circulation, a resection was done, five and a half feet of the lower ileum were removed and an end-to-end anastomosis done with fine silk, no Murphy button being available. The anastomosis was within an inch of the ileocecal valve, and the appendix, lying in close contact with it, was removed. The abdomen was partially closed after thorough irrigation with salt solution, and several gauze strips were left in for drainage.

The patient reacted well from the operation, and on the fourth day had a large semisolid stool. Similar movements occurred on the fifth and sixth days. The drainage strips were removed on the fourth day, and, until the evening of the seventh day, the temperature was not above 99° F, and the general condition was good. The pulse, however, remained rapid, only dropping to 90 on one occasion. Nutrient enemas were retained, and there was no nausea.

The pulse became weaker, and death occurred on March 10, nine days after operation, from general peritonitis.

The case was of special interest because of the comparatively slight reaction on the first day, and the unusual combination of a volvulus and a large mass of intestine strangulated through a mesenteric rent, evidently of recent origin, and occurring without a history of any strain or trauma to cause it.



FIG 1 —Knuckle of intestine herniated through rent in mesentery, and strangulated, director passes through the mesenteric opening



# THE CURE OF FEMORAL HERNIA.<sup>1</sup>

RESULTS OF ONE HUNDRED AND TEN OPERATIONS BY A SINGLE  
METHOD

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THIS title has been chosen as indicating a fairly large number of femoral hernias to have been operated upon by a single method, and by the same operator. Also, as indicating that a variety of methods are used by different operators, or even by the same operator.

It is only fair at the outset to state that any method that clears the femoral canal completely of all displaced tissue, and that constricts the femoral opening with a suture that is not too quickly absorbed, will be pretty sure to be attended by a fair amount of success.

As the operation to be described has been used by me for fifteen years, since March 4, 1890, in 110 cases with only one actual recurrence, it seems worthy of record. Its perfect simplicity and ease of performance would also make it seem desirable that it should be more generally known. While I have taught it during all of these years to my classes at the Post-Graduate Hospital, it has remained unpublished. It is so simple as to readily suggest itself, and undoubtedly has been used by many operators, both before and since I began it.

The cases here recorded have been met with in operating upon a series of 1250 abdominal hernias. The 110 femoral hernias were in 99 patients, 83 of whom were females and 16 males. Eighty-eight patients had single and 11 had double femoral hernia.

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<sup>1</sup> Read before the Surgical Section of the New York Academy of Medicine, May 5, 1905



Of the single hernias, 59 were on the right side and 29 on the left. One patient had double femoral hernia and left inguinal. Three had double inguinal and single femoral hernia. Two had single femoral and inguinal hernia on the same side, making five cases who had femoral and inguinal hernia on the same side. Six had femoral hernia on one and inguinal on the opposite side.

In 28 patients, strangulation of the hernia existed at the time of the operation, and 82 were operated upon for the cure of the hernia.

The ages were, 4 under 10 years of age, 6 between 10 and 20 years, 18 between 20 and 30 years, 34 between 30 and 40 years, 15 between 40 and 50 years, 11 between 50 and 60 years, 5 between 60 and 70 years, 5 between 70 and 80 years, 1 over 80 years.

The youngest patient was eight years of age and the oldest eighty-one years. The latter was operated upon in a private house, in the middle of the night, for femoral hernia of enormous size that had existed for thirty years and which had been strangulated for six hours. She lived nine years after the operation, during which time she wore no truss and had no recurrence.

*Mortality*—In the entire number only one death has occurred, and that was an old woman of seventy years, who had suffered from strangulated hernia for three days, during which time she had been subjected to the most violent attempts at reduction. Perforation of the bowel was found, and, owing to the moribund condition of the patient, the intestine was fastened in the wound and freely opened. She died of exhaustion twenty-four hours later.

*Recurrences*—In one case recurrence occurred three weeks after the operation from violent vomiting due to acute indigestion. This case was reoperated upon eight months afterwards, and has remained cured three years. One patient, a man, who had double inguinal and right femoral hernia, was supposed to have a recurrence of the femoral hernia. Upon reoperating, the protrusion was found to be subperitoneal fat that had slipped through under Poupart's ligament, but no

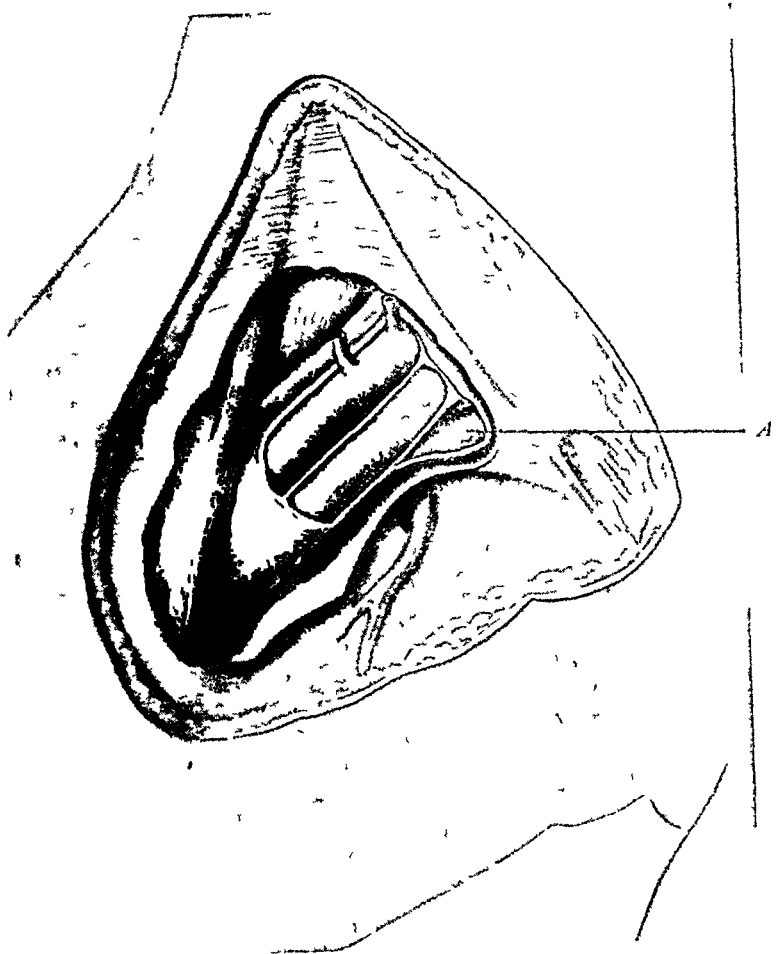


FIG 1—(Gray) A showing small pocket by side of femoral vessels where hernia usually protrudes, breaking down Gimbernat's ligament and forming an elongated, triangular opening. The top of this triangle is Poupart's ligament, the floor the tissues covering the ramus of the pubes, its base the femoral vessels, and its point the spine of the pubes.

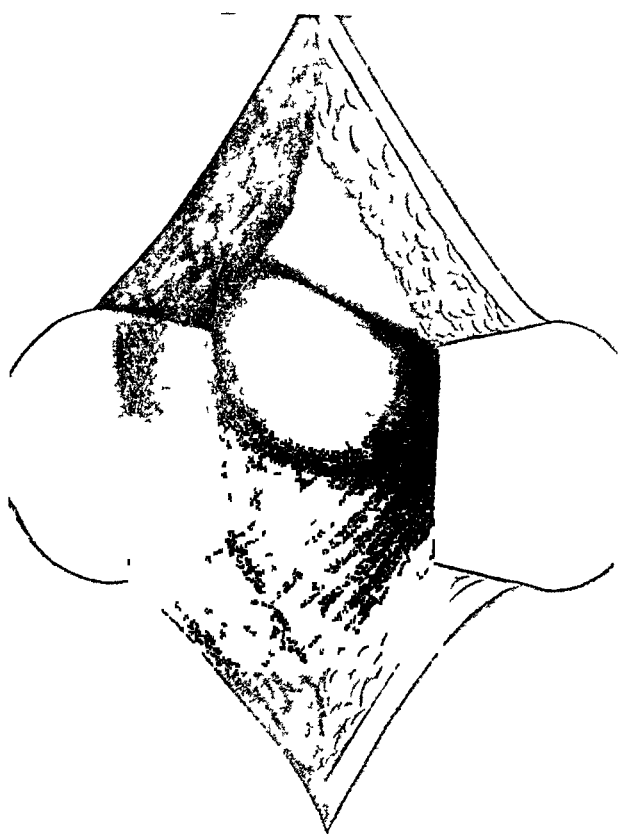


FIG. 2.—Showing protrusion under Poupart's ligament. The femoral vessels are to the outer side of the sac. The sac should have been shown with smaller neck.

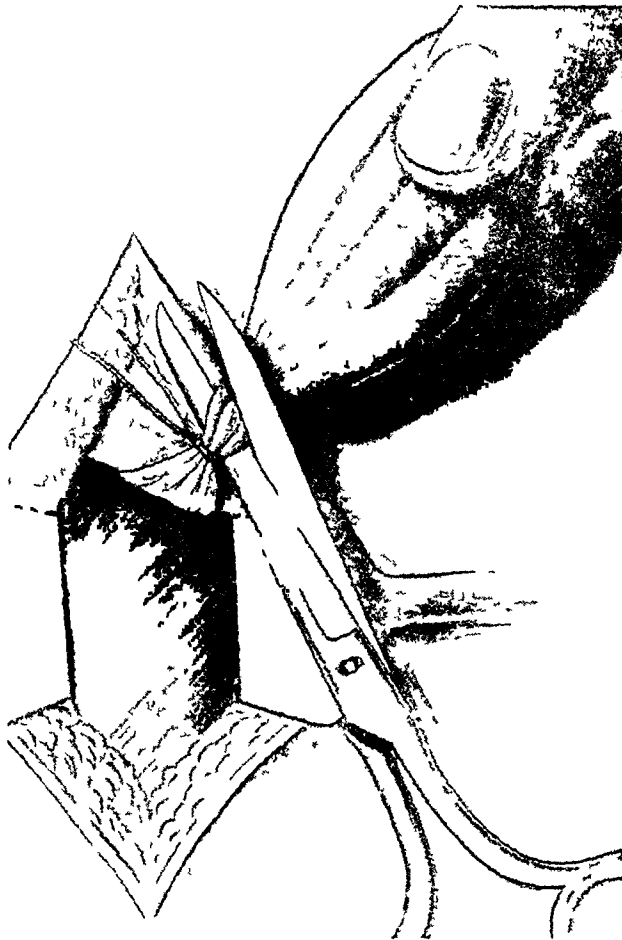


FIG 3—Sac forcibly drawn down while being ligated and cut away This after examining its interior to see that no adhesions exist



hernial sac had formed. In one other case, believed to be identical with the one just narrated, a woman of thirty-five years, had a small swelling in the femoral region nine months after operation. A light truss was applied and worn one year, and she has now been five years without support and no protrusion. It is believed that this also was a small protrusion of subperitoneal fat, and absorption was produced by truss pressure. I have never seen a femoral hernia cured by truss pressure, no matter how young the patient nor how small the protrusion.

One woman of seventy-five years of age had a recurrence within eight months of the operation, and, so far as I know, this is the only actual recurrence. By far the greater number of these cases have been traced and the permanence of the cure ascertained.

Three cases operated upon were recurrent following some previous operation, the character of which is unknown. All of these recurrent cases have remained cured for more than four years.

Two cases had by mistake been operated upon for inguinal hernia, when, in reality, femoral hernia existed, and it is a rather remarkable fact that both were operated upon by operators noted in other lines of surgical work.

*Contents*—Contents of the hernias were in most instances intestine or omentum, or both. In one instance, a small and unhealthy ovary was found in the sac. In two cases of strangulation with quite acute symptoms, appendices epiploicæ were found strangulated. In these cases the bowel itself was held firmly against the femoral opening, but the lumen of the intestine was not constricted. Cysts in or around the sac were found in four cases.

In one case, the daughter of a well-known physician, strangulation was coincident with the first protrusion of the hernia. In stepping from a railroad-car, the step being much higher than she had estimated, a hernia was forced through the femoral canal, and at once urgent symptoms presented.

*Operation*—The incision for the operation here described should be between two and three inches long, parallel with

and to the inner side of the femoral vessels (Fig 1) The upper angle of the wound should be well up over Poupart's ligament and extend down over the saphenous opening Many times the line of separation between the superficial fascia and the deep transversalis fascia, that has been pushed down in front of the peritoneum by the hernia, will be so distinct as to lead the operator to feel that he has the true sac On cutting through this, however, he will come upon the subperitoneal fat (sometimes mistaken for adherent omentum) and then reach the bluish-white, true hernial sac As in other locations when the true sac is opened, there is almost uniformly found evidence of the normal abdominal fluid and the shiny surface characteristic of peritoneum

When the skin and the superficial fascia are incised, usually the sac and its subperitoneal fat will come into the wound with the appearance of an encysted lipoma (Fig 2), and, before separating the sac, it is best that this entire mass should be lifted out of its bed by thumb forceps and blunt dissection, so that its neck where it passes under Poupart's ligament shall be entirely free from its surroundings By traction on the sac (Fig 3) and its superimposed fat, this neck may not only be freed, but it will be materially lengthened, so that when it is finally ligated and cut off it will retract within the abdominal cavity, leaving the femoral canal free of foreign tissue This is absolutely essential to the subsequent permanent cure of the case

The sac should be opened, and where omentum is found adherent it should be carefully ligated, cut away, and its stump reduced to the abdominal cavity Adherent intestine will rarely be found, but where it is, the adhesions must either be broken up, or, if too firm, the adherent part may be cut out of the sac and left attached to the bowel When in doubt, the latter method is by far the safer Adherent omentum is frequently found, and should be cut away after careful ligation

The sac, having been entirely freed of its contents, is tied off as high up as possible while it is being forcibly drawn down by an assistant Great care must be used to insure the perfect

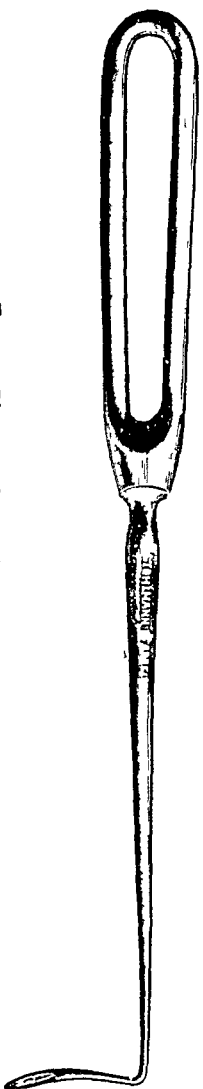


FIG 4.—Blunt needle used in putting sutures in place



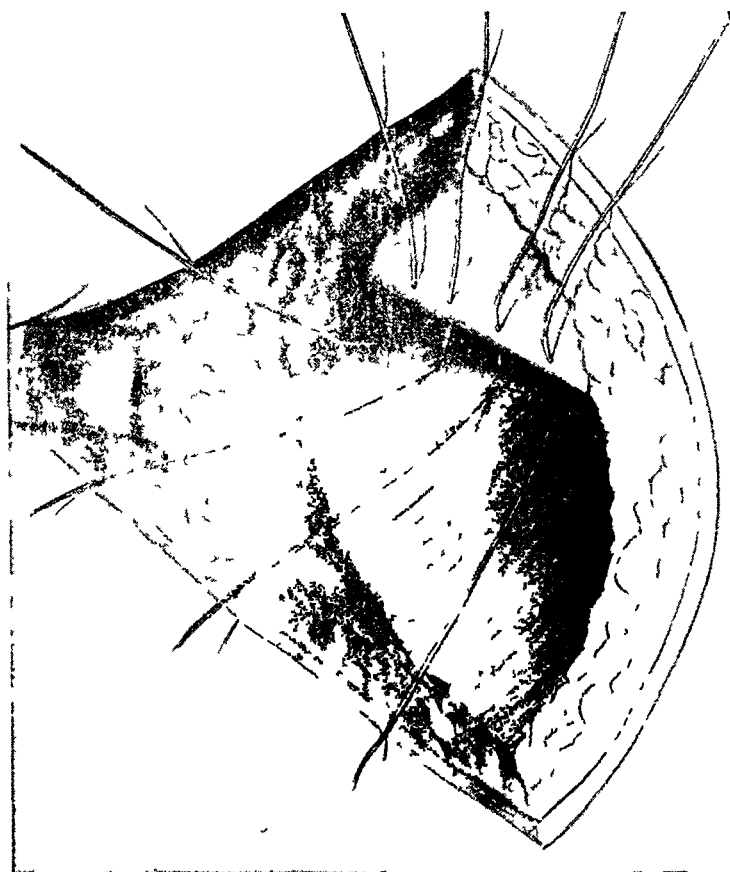


FIG. 5.—Showing sutures of kangaroo tendon passing through Poupart's ligament above and through all tissues to periosteum of ramus of pubes

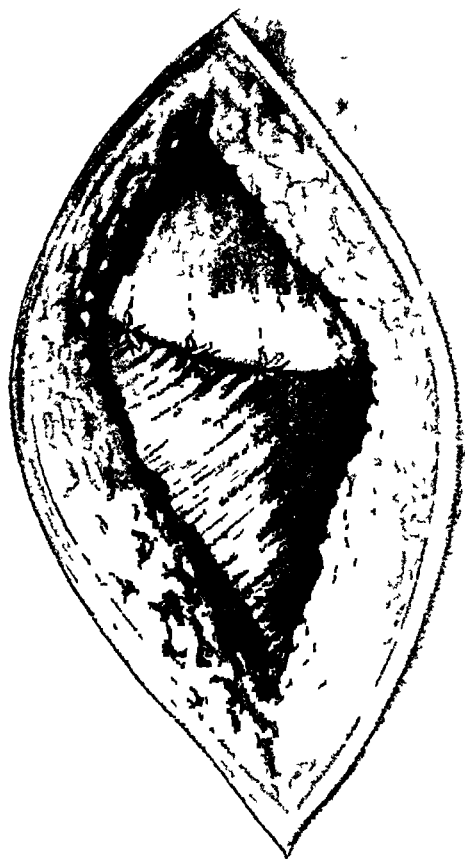


FIG 6—Showing depression of Poupart's ligament to ramus of pubes  
by sutures tied down



freedom of the neck of the sac from protruding bowel or omentum while the ligature is being placed. After tying with strong catgut (a double strand of No. 2 plain is preferred), pass the needle, which has been previously threaded with it, through the neck of the sac and tie again. This gives a double ligature anchored by perforation between the two and prevents slipping off.

When the sac is cut away the stump should be examined to be sure that no bleeding vessels remain, and not until then should the ends of the ligature be cut. When the ligature is cut the stump usually retracts within the abdomen. If this is prevented by connective tissue which has not been broken, it should be carefully pushed back, leaving the femoral opening absolutely free.

This opening is closed in the following manner by good sized kangaroo tendon threaded in a strong blunt needle (Fig. 4). Press the end of the finger firmly into the femoral opening under Poupart's ligament, and pass the needle through the ligament upon the finger-point. This perforation should be well towards the outer side of the canal and close to the femoral vein. The operator should assure himself, by pressure of the finger against the ramus of the pubes, that the vessels are out of the way, and then pass the point of the needle fully down to the periosteum of the pubic bone, taking up all tissues over it. This constitutes the first stitch, but should not be tied until the others are in place. Others should then be placed in the same manner every quarter of an inch apart until near the spine of the pubes (Fig. 5). Usually three or four will completely close the femoral opening.

When tied down and the ends cut moderately close (Fig. 6), the fascia should be closed in by plain catgut, to avoid a pocket in the tissues that otherwise may result, and the skin may then be closed by buried sutures of plain catgut. I have usually covered the wound by collodion and a compress of sterilized gauze held in place by a figure-of-eight bandage.

In ten days the dressings are changed and a bandage for temporary support is applied. If healing has been complete

the patient is allowed to sit up on the tenth day and leave the house on the fourteenth day after the operation

The bandage used after the first dressing consists of a pelvic belt, of three thicknesses of canton flannel, with a compress of gauze over the former site of the hernia, and a perineal strap to prevent its slipping up. This is to be worn for four weeks. No truss or other permanent support should be worn.

As it is not an uncommon occurrence to have both inguinal and femoral hernia on the same side, it is deemed best to say a few words regarding the combined operations.

A single incision will answer every purpose, but it should be a little longer, beginning over the centre of the inguinal canal and curving downward, passing to the inner side and parallel with the femoral vessels to the saphenous opening. This incision gives easy access to both canals. The femoral sac should be removed and the canal closed in the manner already described, after which the inguinal hernia should be operated upon the same as though no complication existed.

*Suture*—The idea that the suture in the operation described would make too much pressure on the femoral vein is a very natural one, but it is believed that with ordinary care this will never occur. At least in the cases presented no indication of undue pressure has ever been observed.

There has been no change in the technique of this operation during the fifteen years of its use by me, except in the suture material.

In the first twenty-two operations, No. 10 braided silk was used for closing the femoral opening. In three, silkworm gut was employed, but in the last eighty-five cases, *ie*, since November 20, 1896, kangaroo tendon has been used exclusively. There can be no question at the present day, it would seem to me, that the last-named substance approaches more nearly than any other the ideal suture for this purpose.

The deep sutures have been placed by a blunt needle with handle (Fig. 4). It is believed that the use of a sharp needle, or even a blunt needle in a holder, is attended by considerable danger of injury to the femoral vein.

# PUNCTURED WOUNDS OF THE BLADDER.

REPORT OF A CASE, WITH A REVIEW OF THE LITERATURE

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WOUNDS of the urinary bladder are extremely uncommon. They are among the rarest surgical affections of that organ and are seldom observed in civil practice, except when produced by a surgeon's instrument. As Vidal said, "Il y a plus des plaies de la vessie faites par le chirurgien que des plaies dues à des accidents." The relative infrequency of wounds of the bladder is well shown by the following figures. Among 10,867 surgical patients treated at Bethany Hospital in eight years there were only three cases of bladder injury, there were only two such cases in 16,711 surgical patients admitted to St Bartholomew's Hospital between 1869-75 (quoted from Bartels). In the 408,072 cases recorded in the War of the Rebellion, not a single case of punctured, incised, or lacerated wound of the bladder was reported, and there were only 183 cases of bullet wounds. These statistics serve to emphasize two points. (1) Wounds of the bladder are extremely uncommon. (2) They occur most frequently in the experience of military surgeons.

The following case from the service of Dr Evans, of La Crosse, and reported before the Wisconsin State Medical Society in June, 1904, is of unusual interest, and forms the basis of this communication. On account of the relative infrequency of such accidents it has seemed to us that a brief summary

of the literature in connection with this case might not be without interest

The history of the case is as follows

J B, aged eighteen years, while painting in St Francis's Hospital, May 4, 1897, fell from a scaffolding, a distance of several feet, striking on the end of a slat eighteen inches long, two inches wide, and one-half inch thick, with two nails one and a quarter inches long driven transversely through the end (Fig 1)

This slat entered the perineum just in front and to the left of the anus, tearing the sphincter ani muscle, the anterior wall of the rectum, and entered the bladder, producing a transverse wound of the trigone, two inches in extent, and separating the urethral from the ureteral openings. The point of the slat perforated the fundus of the bladder and entered the peritoneal cavity. The patient himself withdrew the stick, and in doing so drew out with it a piece of the omentum, which protruded from the wound about eight inches (Fig 2)

The external perineal wound measured about two inches in length

When found, the patient was considerably shocked. He was taken to the operating room, and immediate laparotomy was performed. Considerable urine, mixed with blood, was found in the peritoneal cavity, which was washed out with large quantities of normal salt solution. The rent in the fundus of the bladder, about one and a half inches long, was closed by three tiers of sutures,—the first two of catgut, the last of silk. The peritoneal cavity was again washed out and the abdominal wound closed without drainage.

Through the large perineal wound a drainage-tube was placed in the bladder, and the wound packed firmly with iodoform gauze. The patient returned to bed in good condition. The abdominal wound healed promptly. The patient suffered from severe iodoform poisoning, the symptoms coming on thirty hours after the operation, and rapidly subsiding after replacing the iodoform with plain gauze packing.

At a second operation, fourteen days later, the laceration of the bladder, rectum, and perineum was repaired. An examination of the perineal wound by means of retractors, separating the edges



FIG 1 —Photograph of slit which perforated perineum, rectum, and bladder, entering finally peritoneal cavity



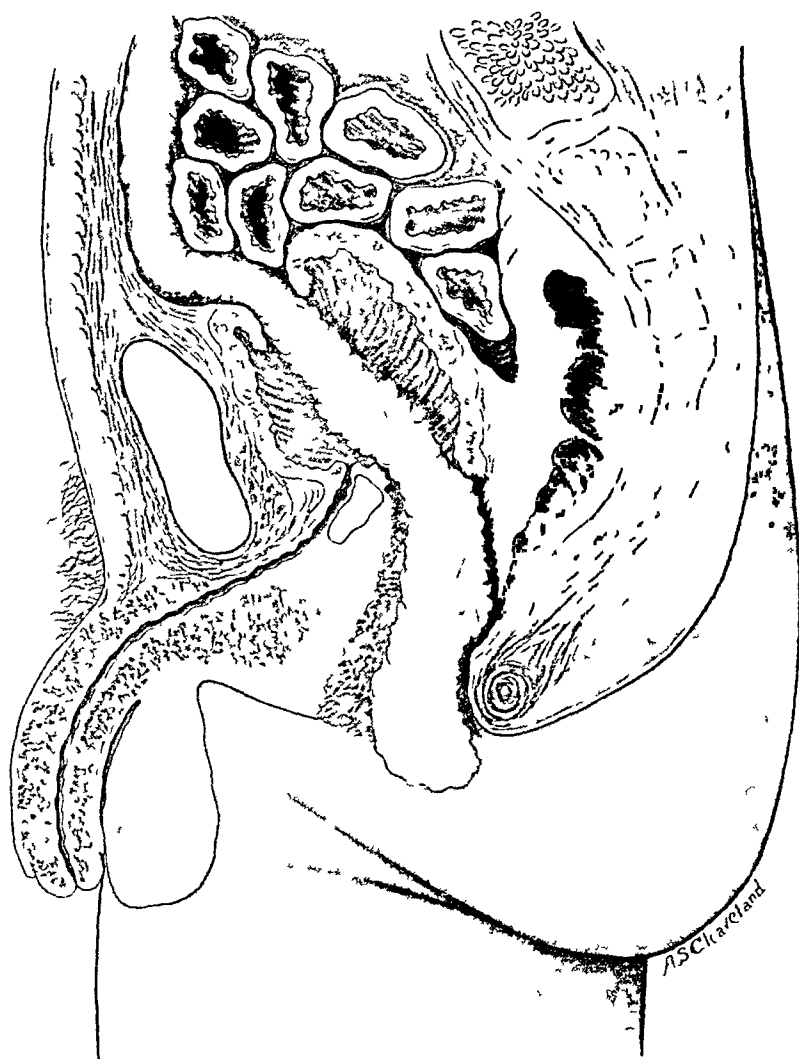


FIG 2—Longitudinal section of pelvis showing track of wound with mass of omentum occupying it and protruding through perineal wound

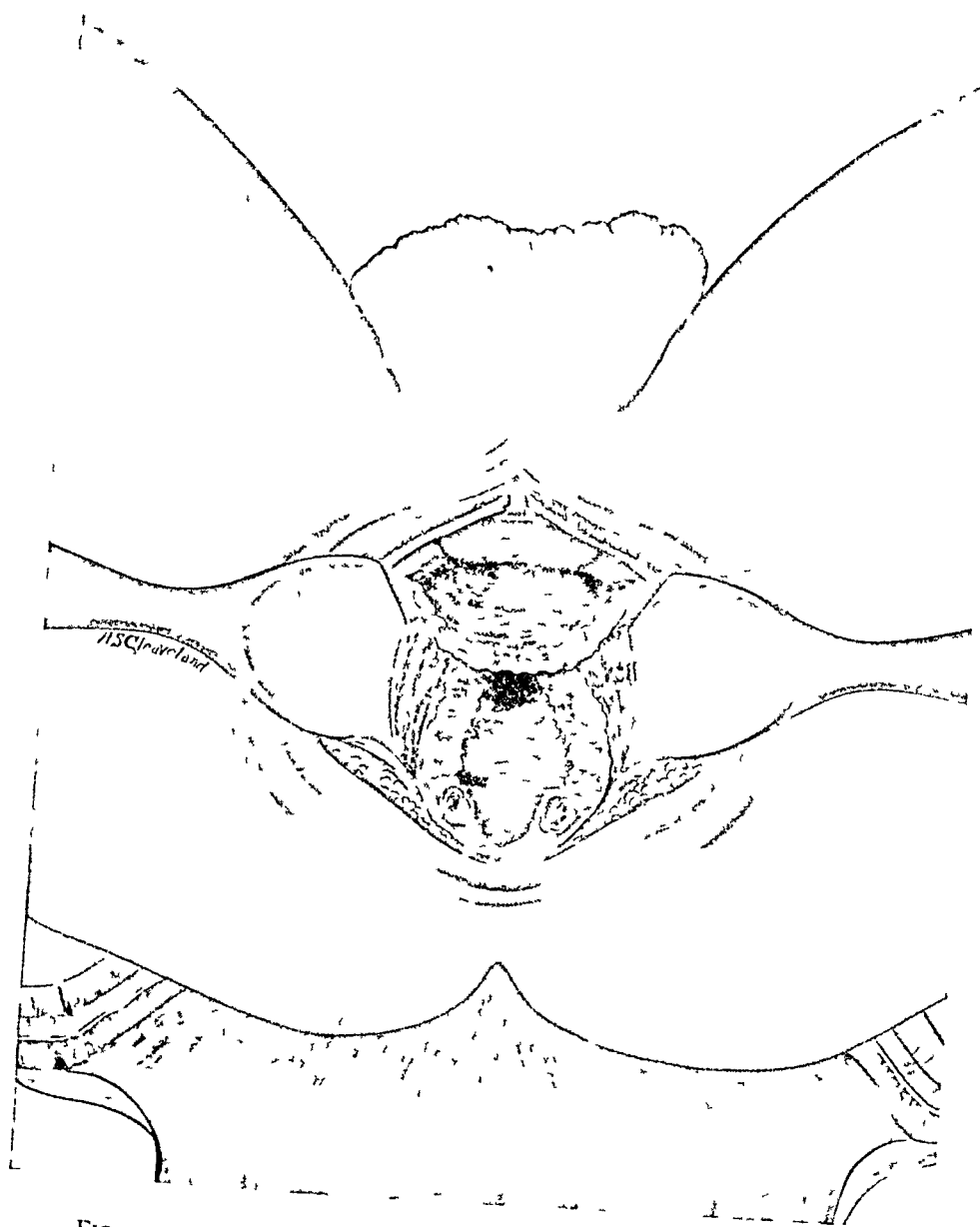


FIG 3—Wound in perineum dilated, exposing wounds in bladder and rectum

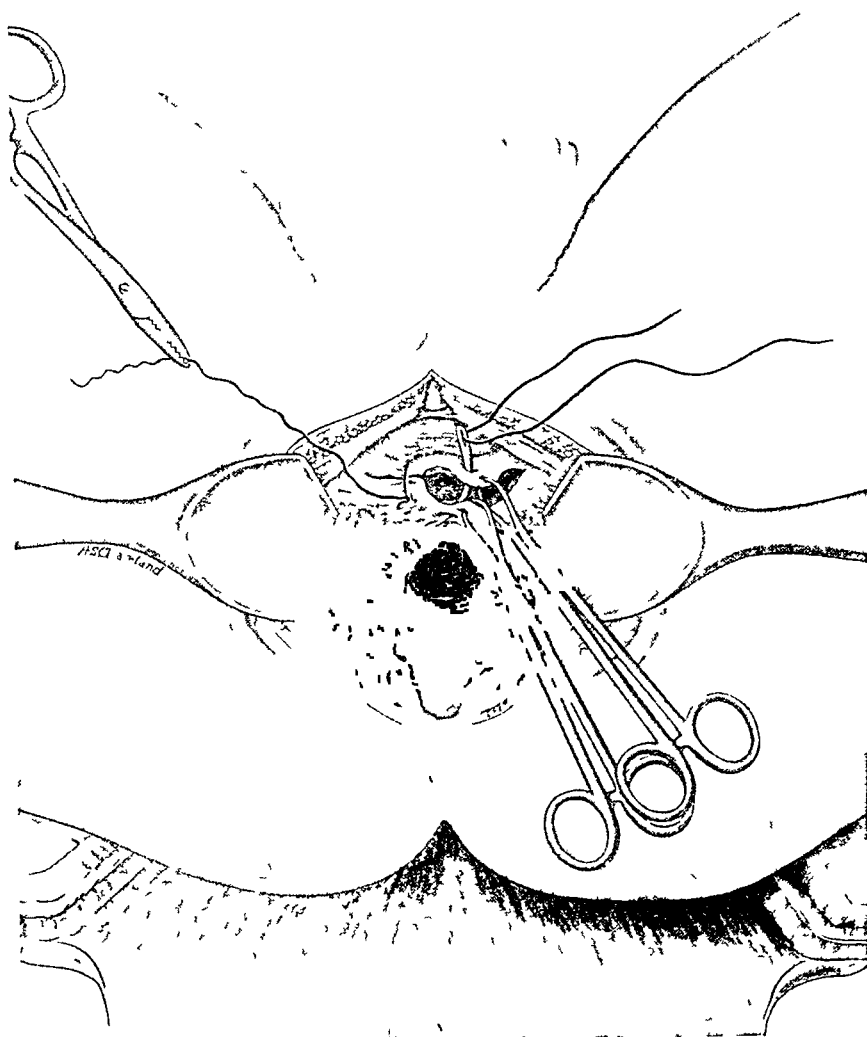


FIG 4 —Repair of bladder wound

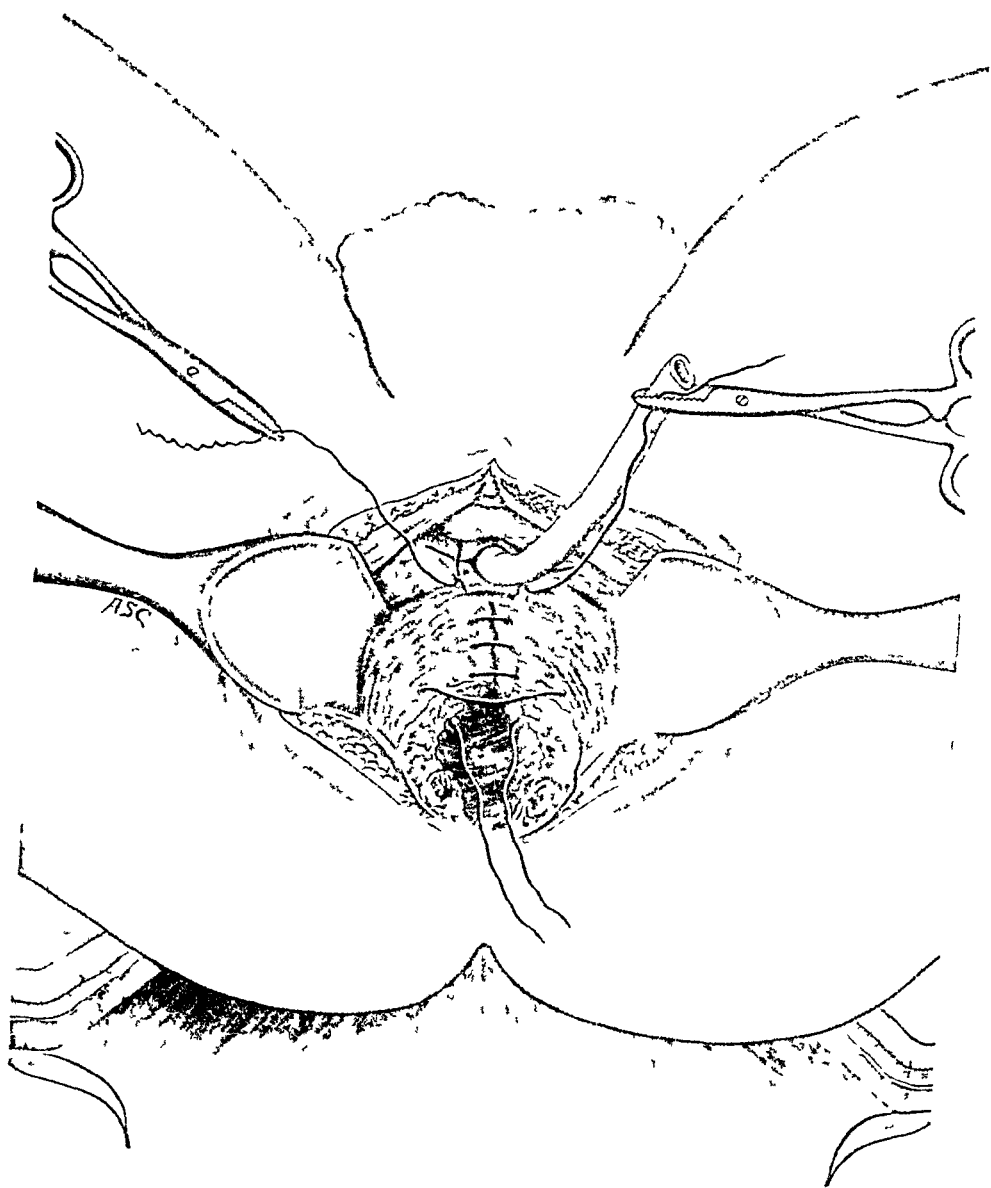


FIG 5 —Repair of rectal wound

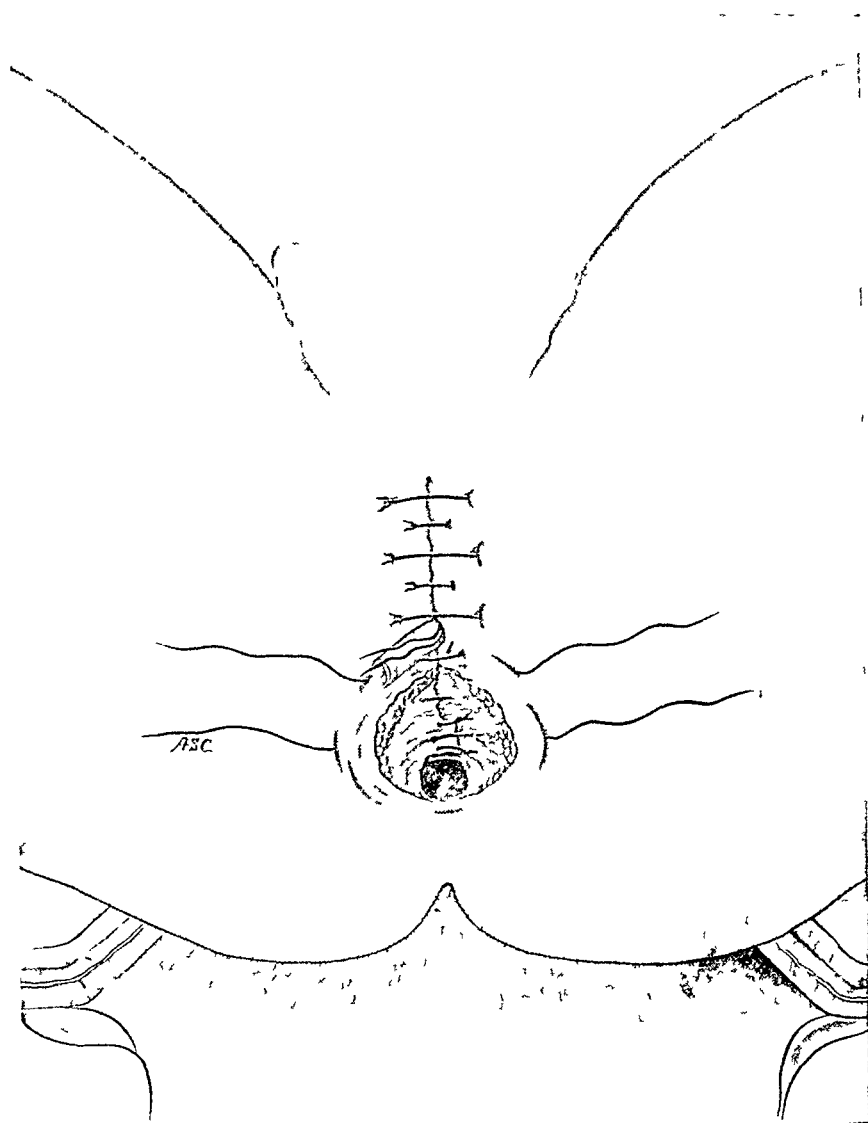


FIG 6—Final layer of superficial sutures closing perineal wound

widely, showed that that portion of the trigone where the ureters enter the bladder was converted into a convex surface, on which the ureters could be plainly seen discharging their contents (Fig 3)

The posterior edge of the wound was grasped with bullet forceps and drawn forward to the anterior edge, which was just behind the prostate, and held in position by the prostate fascia. The margins of the wound thus approximated were held in position by two silk sutures on either side of the middle line (Fig 4). These sutures were tied, and the ends left long and brought out beside a drainage inserted into the bladder in the middle line.

The laceration of the rectum was next closed by a layer of catgut sutures tied on the mucous membrane (Fig 5). The separated ends of the sphincter ani muscle were approximated and secured in position by silkworm-gut sutures. The superficial perineal wound was then closed as tightly as possible about the drainage-tube by catgut sutures (Fig 6).

Recovery from the second operation was satisfactory. A vesicorectal fistula persisted for two months, which gave rise to some annoyance, but at the end of this time it was completely closed. Four months after this operation the bladder held six ounces, and the patient had to rise only once at night. One month later examination showed that the urine was normal and the patient was free from any rectal or vesical symptoms. Two years afterwards he reported that he was well and was without any functional disturbance whatever. Recently, the patient reports that his sexual and urinary functions are normal.

*Remarks*—The above case presents several interesting features.

1 The circumstances surrounding the injury were most fortunate, allowing immediate laparotomy and suture of the intraperitoneal wound of the bladder.

2 The wound of the perineum, rectum, and trigone was so extensive as to necessitate surgical interference for the restoration of function. It may be noted here that this is the only case on record, so far as we have been able to discover, requiring an operation for the repair and closure of a perineal wound of the bladder.

3 The restoration of function was complete despite the severe injury to the trigone and, one would think, to the seminal vesicles and ducts

Wounds of the bladder may be divided for convenience into (1) those presenting an external wound, and (2) those showing no external wound. The first may be subdivided into (1) puncture wounds produced by either (*a*) sharp instruments or (*b*) blunt instruments, and (2) bullet wounds, the second class includes cases of rupture. The bladder in its normal position is well shielded by the pelvic bones. These form a sufficient protection from injury by sharp or blunt-pointed instruments, except in unusual and infrequent accidents, as is shown by the experiences in the Civil War, where no injuries of this kind were reported. The bony pelvis, however, offers an insufficient barrier to penetrating wounds produced by bullets. Hence, as we would expect, the number of cases belonging to this class is very much greater, and they occur chiefly in times of war.

When the bladder has become overdistended, as the result of obstruction to the escape of urine, due either to a stricture of the urethra or, more commonly, to pathologic changes of the prostate, its walls may become stretched and much thinner than normal. Under these conditions, rupture of the bladder is not infrequent. Numerous cases of this kind are reported in the current literature. From these reports we learn that this accident often follows the most trivial injuries, such as slight falls, without any evidence whatever of external injury. The bladder, distended with foul urine, with its walls thinned by chronic overdistention, and often rendered less resistant by inflammatory changes, ulceration, etc., gives way with a slight sudden increase of pressure. The changes in the urinary tract producing conditions favorable to rupture of the bladder are not uncommon, and therefore rupture of the bladder is not a rare accident. It usually occurs in a bladder the seat of disease, the contents of which are generally infected, puncture wounds and bullet wounds, on the other hand, usually involve a normal bladder, the contents of which are sterile. This

broad distinction between the two classes of cases has much to do in explaining the relative mortality in these cases

*Historical* — Wounds of the bladder were described in the earliest times. Thus, Homer, in the *Iliad*, refers twice to this accident as rapidly fatal. The well-known aphorism of Hippocrates, “*Cui persecta vesica lethale*,” has been often quoted to show that wounds of the bladder were considered by the ancients to be invariably fatal, and, so far as statistics of injuries of the bladder following accidents go, this was true. It has been alleged that there were many cases of recovery from wounds of the bladder known among the early writers, but so great was the reverence for the writings of Hippocrates, that these early observers doubted the correctness of their diagnosis, and were unwilling to record observations not in accord with the teachings of Hippocrates. It is more likely that a distinction was made at an early period between traumatic injuries of the bladder and those purposely made by the surgeon, and that even the former were not regarded as invariably fatal. Aristotle distinctly states that injuries near the neck of the bladder heal, and Galen records a case of recovery from wound of the bladder, and in commenting on the aphorism of Hippocrates contended that the idea conveyed by the language used was not that these wounds were absolutely fatal, but very dangerous.

Since injuries of this kind occur most frequently in military practice, it is quite natural that the first systematic account of them should be written by a military surgeon, D. J. Larrey, published in 1817. The elaborate and extensive memoir of Larrey records his careful and accurate observations made during his extensive experience in the Napoleonic wars. It is the first attempt at a complete and systematic study of the subject, and forms the basis for the further observations by later writers.

The next most important contribution was that of Stephen Smith, “*A Contribution to the Statistics of Rupture of the Bladder, with a Table of Seventy-eight Cases*,” published in the *New York Journal of Medicine*, 1851. This was followed



by the reports of two Frenchmen, Demarquay, in 1851, and Houel, in 1857. In 1876 appeared the report of George A. Otis, in vol. 11, part 2, of the "Medical and Surgical History of the War of the Rebellion," containing an exhaustive summary of the records of the Civil War.

In this important work Otis analyzes and summarizes the experiences of the Civil War, and gives in the text and the footnotes numerous critical references to the early literature, which exhibits an extensive acquaintance with the whole subject. He points out that Larrey was the first to call attention to the fact that, while all accidental injuries of the bladder are very serious, those produced by shot are less dangerous than the others, and suggested that this was likely due to the nature of the wound, which was less favorable to urinary infiltration into the surrounding tissues. This same observer pointed out that the danger of bladder wounds depended in a measure on the contents of the bladder as to the degree of plenitude or vacuity at the time of the accident.

In a very important article under the title "*Die Traumen der Harnblase*," published in 1878, Max Bartels collected from the literature all the cases of wounds of the bladder which had been reported from the earliest times up to the date of publication of his article. These cases are divided into three groups,—puncture wounds, bullet wounds, and ruptures. A short abstract of each case is given. The statistics of each group are analyzed separately, while a general summary is presented in tabular form.

Bartels was the first and the only writer so far to collect all the reported cases scattered through the literature, for the purpose of comparison and analysis. The statistics furnished by this study are most valuable, and have been extensively quoted since by every writer on this subject.

The statistics included in this critical study may be taken to represent the results in this class of cases before the advent of modern surgery. In the great majority of cases the most that was done was to drain the bladder by a permanent catheter and cleanse the superficial wound. Operation was rarely

resorted to, and then only as symptoms developed demanding surgical interference, such as extravasation, abscess formation, etc. Just previous to the publication of Bartels's review, considerable interest in the question of operative interference in cases of wounds of the bladder was aroused by the report from America of a case of intraperitoneal rupture of the bladder successfully treated by laparotomy. This was the only case in Bartels's list of wounds of the bladder involving the peritoneum terminating in recovery, the one exception in a total of ninety-four collected cases.

Since the publication of Bartels's critical review, quite a number of cases of puncture wounds of the bladder have been recorded in the various journals, some of which are not easily accessible. These cases occurring since 1878 are particularly interesting as showing what advances surgery has made in the past three decades, and how these cases, which were formerly considered inevitably fatal, may now be saved by prompt interference.

In the English text-books of surgery very little space is given to this subject. It has therefore been considered of some practical interest and importance to give the results of the analysis of these scattered reports, which we have collected in connection with the case reported above. While we do not believe that our search of literature has been exhaustive, yet our list probably contains nearly all the cases on record since 1878, and, taken together with the list published by Bartels, forms a fairly complete record of the published cases.

In the following list the cases are arranged chronologically with reference to the date of the publication of the report, except in the last two cases. Following the name of the reporter, a short abstract of each case is given to indicate the sex and age of the patient, the nature of the instrument inflicting the wound, the point of entrance, the nature of the wound in the bladder, the treatment employed, and the result.

I BEACH—Boy, aged sixteen years, sitting on a window sash containing no glass. The sash gave away, and the boy fell on one of the upright pieces of the frame. Entrance through anus and rectum into the

bladder above the prostate gland The patient pulled the piece of wood out, which was followed by copious hæmorrhage Bladder wound admitted two fingers separated one-half inch Treatment retention catheter, rectal tube in bowel Irrigation with thymol solution Recovery in twenty-seven days

2 BEACH (Buce's case) —Man, aged forty-six years, pushed from load of fagots and fell on a stake driven into the earth Entrance through anus and rectum into bladder immediately behind prostate gland Intense pelvic pain Treatment patient was bled and full doses of opium given Recovery in two months

3 *Boston Medical and Surgical Journal*, 1879 —Farmer, aged thirty-two years, while descending from hay-mow fell on a sharp cart stake fourteen inches long and two inches in diameter at base Entrance posterior to anus, into bowel, through anterior wall of rectum into bladder just behind the prostate Bloody urine was withdrawn with catheter Treatment rest and cleansing of wound, catheterized every three hours Temperature never rose above 102° F Recovery complete in six weeks

4 TREVES —Seaman, aged twenty-three years, stabbed with knife He walked into the dispensary, but was in a condition approaching collapse from loss of blood Entrance wound one inch long, clean cut, situated exactly in middle of left buttock No complaint at first Two days later symptoms of peritonitis appeared, and on fifth day after injury the patient died Autopsy showed that the knife had taken the following course through the gluteal muscles, divided part of great sacrosciatic ligament, passed through small sciatic notch, completely dividing the pudic artery and nerve and one vein, then entered the bladder at its lower part close to the trigone, making a wound large enough to admit tip of the fore-finger

5 STOKES —Boy, aged sixteen years, laborer in foundry, in play was vaulting over a pair of long forger's tongs Failed to clear the tongs and came down on the long handle, which passed into anus, symptoms of peritonitis developed immediately, and patient died seventy-four hours after injury Autopsy general peritonitis, subdiaphragmatic collection of pus Double perforation of bladder, fundus perforated a little to left of median line

6 JACKSON —Carman, aged twenty-four years, while loading a truck slipped and fell on a "trolley," such as railway porters carry This tore his trousers and entered the rectum Great suprapubic pain and pain in rectum, sphincter ani paralyzed and dilated, bowel contained blood Six ounces bloody fluid withdrawn by catheter Rent in bladder one inch above prostate Recovery in one month

7 GALLER —Young man, aged twenty-four years, stab-wound 2 centimetres long over left inguinal canal, cutting half-way through the vas deferens Blood and urine escaped from wound Symptoms of peritonitis developed Retention of catheter for six days Recovery in forty-four days (Writer states peritoneum was opened but there is no evi-

dence of injury of peritoneum except symptoms of transient peritonitis, so we class this as extraperitoneal )

8 PANIZO—Man, incised wound in hypogastric region one to two fingers above symphysis, wound 9 centimetres long, extending obliquely upward and outward Bloody fluid from wound Catheter in bladder felt through the wound Wound in bladder and peritoneum each 6 centimetres long These closed at operation by catgut interrupted sutures Large abscess formed in wound after operation extending up to xiphoid cartilage, two litres of pus evacuated on the sixth day, followed by multiple ulcers over sacrum and trochanters, abscess reformed above symphysis Final recovery in three months

9 LIVON—Man, aged forty years, house painter, stabbed with knife in hypogastrium little to left of middle line 3 centimetres above symphysis Catheter withdrew 500 cubic centimetres bloody urine Following injury, urine all came through wound No symptoms of peritonitis Retention of catheter nineteen days Recovery in eleven weeks

10 FIORANI—Man, aged thirty-three years, stabbed with a knife Entrance, right genitocrural fold Tenesmus immediately following injury, passed small amount of bloody urine Pains in abdomen, fulness in pelvis and dulness in hypogastric region with pain on pressure Cystotomy performed ten hours after injury, rubber drainage-tube in incision, no suture Drainage-tube removed in one month Four months after injury patient left hospital, but the dulness in hypogastrium persisted Some time later he returned to hospital, and an abscess was opened in hypogastric region Forty grammes of pus evacuated Eventual complete recovery

11 HENSGEN—Boy, aged seventeen years, on a spree, very drunk, stuck a three-cornered file into his back, which penetrated the sacrum about 10 centimetres above the anus, passing through the rectum into the bladder After the injury the patient rode thirty-five minutes on a train and walked fifty minutes to his home with the file still sticking in his back The wound in the bladder was in the upper part of the posterior wall Symptoms of peritonitis present for a short time Bloody urine When he sat up in bed no urine escaped from the wound, but on lying down the urine was passed from this opening, and was increased by coughing, etc Eventual recovery without operation (Writer believes the peritoneum was injured, but the details of the case, considered in connection with other similar cases, leads us to classify this case as one of extraperitoneal wound of the bladder )

12 BACCHI—Countrywoman, aged twenty-two years, fell several metres, striking on her side on a corrugated step Piece of sharp wood entered right groin, passing upward and inward Copious hæmorrhage Sent to hospital two days after injury Wound 5 centimetres long, extending vertically beneath the labia into the pelvis, emitted fetid odor, and cavity contained clots of blood and ragged tissue Tumor in pelvis soft and pasty Catheter in bladder withdrew fluid injected into the wound Suprapubic cystotomy Peritoneum stripped back, exposing two vertical fissures in inferior posterior portion of bladder below the ureters, one 3 centimetres, the other 1 centimetre long Interrupted suture of both wounds

Drainage through wound in groin Permanent catheter Bladder sutures held, but there was infection of the wound carried in by the foreign body Recovery in six weeks

13 SOULIE—Young man, aged twenty years Knife thrust in left buttock Wound 3 centimetres long, situated behind the superior part of the ischium at the level of the small sciatic notch He passed some bloody urine directly after injury Irrigations into bladder noted to pass out through the wound Treatment suprapubic cystotomy, bladder opened, and formal diagnosis of wound of bladder made, abdominal drainage Recovery Suture of bladder (?)

14 HAMILTON—Boy, aged sixteen years, fell backward in a sitting posture, striking on a newly-cut corn stub, which entered the anus and penetrated the rectum a distance of three inches Passed bloody urine immediately after injury Examination incised wound right side of anus beginning one and one-half inches external to anal margin and extending upward to a point beyond the inner boundary of the sphincter Gas and fæces escaped involuntarily Edges of wound could be separated one-half inch Treatment edges of wound brought together and sutured Suppuration of wound occurred, urine and blood were passed through wound Retention catheter and sedatives Urine through the wound gradually diminished Complete recovery in three weeks

15 ORDRIEZOLA—Journalist, aged thirty-four years, fell on a piece of "cut cane," which entered anus Fainted from pain There was bleeding from the wound Admitted to hospital two days later Stools contained blood and urine He assumed right lateral decubitus with legs flexed on abdomen, and presented abdominal facies, temperature, 39° C Rectal examination rounded wound in upper part of left lateral wall of rectal ampulla Sphincter not lacerated, no external wound Abdomen was tympanitic, vomiting, pulse small Urine passed per rectum Patient catheterized for first time on fifth day after injury, removing fetid bloody urine and blood-clots There was a free communication between bladder and rectum Recovery without operation in two months (Report very fragmentary and incomplete)

16 DELAGENIERE.—Man, aged thirty-four years, empaled on a picket, which entered perineum and perforated the bladder through and through Entrance wound in left side of perineum 4 centimetres long, beginning behind, near the ischium, and extending forward towards the root of the scrotum Bloody urine withdrawn with soft catheter No symptoms of peritonitis being present on admission ten hours after injury, operation was deferred till the following morning, when peritonitis was marked Laparotomy intestines reddened, dark fluid—blood and urine—in peritoneal cavity Bladder distended with clots On posterior surface of bladder was a transverse wound 2 centimetres long This was closed with row of catgut, copious lavage of peritoneal cavity, large quantity of sterile water left in cavity Drain in pelvis This was followed by suprapubic cystotomy Clots removed, wound in trigone discovered, admitting tips of two fingers Wound packed and incision left opened Recovery in two months

17 ALSBERG—Boy, aged nine years, fell on an iron picket fence Entrance inner side of thigh, 10 centimetres below inguinal fold Pierced the symphysis and produced double perforation of the bladder Laparotomy about eighteen hours after injury, suture of wound, removal of clots of blood and fibrin Drainage of operation wound with rubber tube Complete recovery

18 DODD—Workman in royal gun factory pulling on a rope with another man, rope broke, patient fell backward with the other man on top of him, striking on a bar of iron seven-eighths inch in diameter and several feet in length, the end being bent at right angles and sticking up several inches from the floor Entrance wound buttock, entered the rectum two inches above the sphincter, perforated the anterior wall of the rectum, and entered the urethra through the substance of the prostate gland Treatment wound in buttock opened into the rectum as in operating for a fistula Pieces of cloth removed from the depths of the wound Permanent catheter Bladder irrigations Uninterrupted recovery

19 GROSS—Man, aged twenty-four years, fell from height of three metres and was empaled on a stick Entered perineum, passing through the bladder into the peritoneal cavity without entering the rectum On admission to hospital, a few hours after injury, there were no symptoms pointing to a deep wound On the following morning peritonitis was marked No blood or urine escaped from the wound, but a catheter withdrew 150 grammes of almost pure blood Median laparotomy performed Peritoneal cavity contained about two litres of urine A wound 5 to 6 centimetres obliquely transverse near tip of fundus was closed, and a minute toilette of the peritoneal cavity performed, drainage, retention catheter, drainage of perineal wound Patient died the following morning Autopsy spreading peritonitis particularly marked on right side In right flank were found two foreign bodies overlooked at the operation, made up of pieces of skin, undershirt, and trousers

20 WEISCHER—Two men while mowing quarrelled, one striking the other with his scythe, inflicting a wound in the gluteal region Scythe was removed with difficulty Removal followed by escape of blood mixed with urine Wound 7 centimetres long between left posterior inferior spine of ilium and the trochanter, passed inward through the foramen ischiadicum magus and penetrated the bladder No symptoms of peritonitis Treatment drainage of wound with rubber tube and irrigation of the bladder Recovery

21 TUFFNELL—Man was riding on a load of hay with a pitchfork sticking in the hay near him The load was overturned, throwing the man to the ground When picked up, he was bleeding from the bowel No external injury Catheter withdrew no urine Following morning urine passed per rectum Died in five days Autopsy pitchfork tine had split substance of prostate into two equal parts and penetrated the tissues behind the pubis Intestines were matted, exhibiting the usual signs of acute peritonitis, but there was no opening into the peritoneal cavity to be found

22 BIRKET—Man injured by falling on a sharp stake driven into the ground, which entered the anus and pierced the rectum and bladder. There was intense pain immediately following the accident. The wound of the bladder was extraperitoneal. Recovered. (I have been unable to find the original report of this case. The incomplete notes here given are from a reference to the case made by Stokes.)

23 JAWDYNSKI—Man, aged thirty-six years, trader. During a quarrel a knife was plunged into his right buttock. On the operating table the wound was found to be 7 centimetres from the median line, 11 centimetres from the fold of the nates, and 3 centimetres in length. A finger in the wound passed through the ischiatic foramen into the pelvic cavity as far as the rectum. The wound was 12 centimetres deep. It was widened, the gluteal artery ligated, and the wound then closed except for a gauze drain. In the evening the patient complained of inability to urinate, a catheter withdrew bloody urine. The following day the dressings were found saturated with urine. A solution of potassium iodide instilled into the bladder passed through the wound. The wound was then tamponed up to the bladder and a retention catheter used. Complete recovery in three months.

24 ROSENBAUM—Male, aged twenty-nine years, wounded in the abdomen by a dagger. The injury was followed by sharp abdominal pain, desire to urinate but inability to void, prolapse of omentum and bowel. The patient on examination soon after the accident was found in a condition of profound shock. The wound, 6 centimetres long, was situated two fingers above Poupart's ligament, extending upward and to the left and had penetrated the abdominal cavity. There was prolapse of a piece of the omentum the size of one-half a hand and loops of the small intestine. The prolapsed omentum was ligated and excised, the bowel, being uninjured, was returned to the abdominal cavity. A silver catheter withdrew a small amount of bloody urine. The bladder was next examined through the abdominal wound. An opening into the bladder admitting the tip of the index-finger was found. The abdominal wound was enlarged to 13 centimetres and the bladder drawn up out of the pelvis. In doing so, a large quantity of extravasated urine and blood was brought up with it. The wound in the bladder, 5 to 6 centimetres long, was closed with a row of Lembert's silk sutures. The abdominal wound was closed except for a drain at the lower angle. A retention catheter was used. Except for an abscess developing in the scrotum, recovery was uneventful, and the patient discharged well in nine weeks.

The bladder may be reached by penetrating instruments in three ways: (1) through the suprapubic region, (2) the obturator foramen, and (3) the perineum. At these three points the bladder is directly exposed to injury, being unprotected by the bony pelvis. It might be supposed that, being

entirely unprotected from above, the bladder would be frequently lacerated in stab-wounds of the abdomen, that in times of war, bayonet, lance, and sabre wounds would be frequent. In the fierce hand-to-hand fighting, when bayonet charges are resorted to, it seems almost impossible that the bladder should escape. But it is a noteworthy fact that not a single case of bayonet wound of the bladder has been recorded. Indeed, stab-wounds of the bladder through the suprapubic region are not as common as we would expect. It is a curious fact that the bladder is relatively and absolutely more frequently injured by puncture wounds through the perineum. Arranged in order of frequency, we have (1) perineum, (2) hypogastrium (suprapubic), (3) obturator foramen. In the list above, there are several cases in which the entrance wound was not in either of the three regions enumerated, although they might be properly classified as subdivisions. They have, however, been separately classified as follows.

(1) Gluteal region. Five cases,—four by sharp instruments and one by a blunt instrument. Of the sharp instruments, one was a scythe and three were knives. The blunt instrument was a bar of iron (No. 18 in the list).

(2) Sacral. One case, No. 11. This is a unique case as to the location of the wound and the nature of the instrument producing it. This patient was carrying a three-cornered file in his pocket. During a drunken spree, it is supposed that he fell, wounding himself with the file in several places. Finally, he was unfortunate enough to fall in such a way as to run the file through his sacrum 10 centimetres above the anus. With the file still sticking in his back, he rode on the train for thirty-five minutes, then walked for fifty minutes more to his home. A physician was summoned, who, without apparently making a very thorough examination, left a prescription. Sometime after this visit the file was removed from the wound by a friend.

(3) Thigh. One case, No. 17. This is the only case recorded in which the protecting bony framework of the pelvis has been bored through by the penetrating instrument, and



the bladder injured The accident resulted from a fall, the patient was empaled on an iron picket, which, after piercing the symphysis, passed completely through the bladder into the peritoneal cavity

(4) Groin Three cases In two the wound was produced by a knife, in the third by a sharp stake This latter case, the only female in the list, is interesting, as there was produced a double wound in the bladder without an involvement of the peritoneum The stake, entering the right groin, passed obliquely upward beneath the labia, piercing the bladder in two places, making two vertical wounds, and lodged in the cellular tissue of the left pelvic space

The entrance wounds produced by sharp instruments were thus distributed perineum, 1, gluteal region, 4, suprapubic, 3, groin, 2 In every instance but one the injury was the result of a quarrel In marked contrast are the wounds produced by blunt instruments They were thus distributed perineal, 11, gluteal, 1, sacral, 1, groin, 1, thigh, 1 It is a curious fact that such a large majority of these wounds occurred in the perineum, and in every case was the result of a fall from a greater or less height, in every case save one the rectum was also perforated In this last case (No 19), double perforation of the bladder was produced by a fall from a height of 3 metres, the patient being empaled on a stick, which entered the perineum and passed through the bladder without wounding the rectum

*Variety of Instruments* —Among the list of sharp instruments, the wound was made by a knife in seven cases, by a scythe in one case, by a pitchfork tine in one case, and in one case by a dagger There is a greater variety of blunt instruments The list includes the following A piece of wood (stake), six cases One case each of portion of window sash, handle of forger's tongs, "trolley," three-cornered file, stub of corn-stalk, bar of iron and lathe, and two cases of iron picket Double perforation was produced in the last two cases

These cases are tabulated as follows

TABLE 1

PUNCTURE WOUNDS OF THE BLADDER, LOCATION OF ENTRANCE WOUND, INSTRUMENTS

Instruments	Perineo anal		Gluteal		Abdom- inal		Sacral		Groin		Thigh		Total	Died
Sharp	1		4		3				2				10	
Knife				3		2				2			7	1
Scythe				1									1	
Pitchfork tine		1											1	1
Dagger						1							1	
Blunt	11		1				1		1		1		15	
Stake		5								1			6	1
Lathe		1											1	
Window sash		1											1	
Handle of forger's tongs		1											1	1
Porter's 'trolley		1											1	
Three cornered file							1						1	
Corn stalk stub		1											1	
Iron picket		1											1	
Bar of iron				1							1		2	
Total	12	12	5	5	3	3	1	1	3	3	1	1	25	4

*Nature of the Wounds*—Of the 25 cases, 7 were intra-peritoneal and 18 extraperitoneal

*Intraperitoneal*—There were 7 cases with 2 deaths, or a mortality of 28·5 per cent. In 6 cases laparotomy with closure of the bladder wound was performed at varying intervals after the accident. Of these 6 cases, 5 recovered and 1 died, a mortality of 16·6 per cent. The cause of death in this fatal case was a violent peritonitis resulting from overlooking at the operation two foreign bodies in the peritoneal cavity composed of pieces of skin, undershirt, and trousers, which had been carried in by the penetrating instrument (Case 19). One case not operated upon terminated fatally seventy-four hours after injury. Barring the oversight in the case referred to, the mortality in cases operated upon should be *nil*, while the mortality in cases of intraperitoneal wounds of the bladder not operated upon was 100 per cent. This agrees with Bartels's statistics. In ninety-four cases of wounds of the bladder from all causes involving the peritoneum, ninety-three ended fatally,—the one case of recovery was the only case operated upon. In the ten cases of puncture wounds of the bladder in which the peritoneum was injured the mortality was 100 per cent. It may be remarked here that a comparison of the

statistics of these two groups of cases emphasizes the value of operative interference in these cases, and illustrates what surgery has accomplished in this class of injuries

*Extraperitoneal*—Among the cases classified as extraperitoneal are several with symptoms of peritonitis, and for this reason they were reported as cases of intraperitoneal wounds. But in every case the peritonitis was localized and transient, and it seems improbable that the peritoneum was injured in any of these cases. We know, furthermore, from autopsy findings, that symptoms of peritonitis may be marked in certain cases of wound of the bladder, without, however, showing any injury of the peritoneum.

Of the 18 cases, 2 died, a mortality of 11.1 per cent. Neither of these 2 cases was operated upon. Two of the 18 cases were operated upon, and both recovered. The cause of death in the two fatal cases was extravasation of urine with diffuse suppuration (Nos. 4 and 21). In the last case (No. 21), symptoms of peritonitis were marked, although at autopsy it was found that the peritoneum had not been injured.

TABLE II  
GENERAL SUMMARY

No.	Died	Mortality	INTRAPERITONEAL				EXTRAPERITONEAL			
			No.	Died	Mortality	Operated on	Mortality	No.	Died	Mortality
25	4	16 per cent	7	2	28.5 per cent	6	16.6 per cent	18	2	11.1 per cent
									2	0 per cent

*Double Perforation of the Bladder with Injury of the Peritoneum*—Of all injuries of the bladder, puncture wounds which perforate this viscus in two places and produce a laceration of the peritoneum are the most infrequent. This is an exceptionally rare accident. Only two cases are recorded in Bartels's list of fifty cases of puncture wounds. Four additional cases have been collected, and are included in the above

list of intraperitoneal wounds, while the case here reported makes seven cases in all

The two cases collected by Bartels are as follows

1 A soldier in a drunken quarrel was stabbed by a fellow soldier with a "Danish Hohlklunge," which entered the hypogastrium just above the symphysis and a little to the left of the middle line, passing through the peritoneal cavity, the ileum, and the bladder, passing out behind near the coccyx. The wounds were small. Prolapse of the injured bowel. Patient lived twenty-one days.

2 Man, aged forty-three years, fell on the leg of a chair. Entrance through the anus into the bladder. Great pain in the bladder region and pelvis. Collapse. Catheter withdrew bloody urine. Beginning peritonitis. Died in twenty-one hours. Autopsy: rectum and neck of bladder pierced, a second wound of the fundus communicated with the peritoneal cavity. Bloody fluid found in the latter.

The four cases reported in the literature since 1878 are abstracted in the list above, Nos. 5, 16, 17, and 19. In only one case was the wound made by a sharp instrument, No. 1 above, collected by Bartels. The accident resulted from a quarrel.

In six cases the injury resulted from a fall on a blunt instrument, as follows: chair leg, 1, iron picket, 2, handle of forger's tongs, 1, lathe, 1, and stick, 1. In five of these cases the entrance wound was in the perineum. In the sixth case an iron picket entered the inner side of the thigh 10 centimetres below the inguinal fold. In all but one case in which the point of entrance was in the perineum the rectum was perforated and a vesicorectal fistula persisted for a considerable time. In no case was the fistula permanent, and in no case was a separate operation for its closure necessary.

Of these seven cases of double perforation, three were fatal,—one in twenty-one days, one in twenty-one hours, and the third in about thirty hours, a mortality of 42.8 per cent. It is to be noted, however, that the 42.8 per cent represents the total mortality, including the cases which were operated upon and those which were not. If we analyze the cases farther, we find that in three cases no operation was performed, and all ended fatally, giving a mortality of 100 per cent. In the four

cases subjected to laparotomy and suture of the bladder wound and peritoneum three cases were saved, thus giving a mortality of 25 per cent. This fatal case died from peritonitis resulting from a foreign body introduced into the peritoneal cavity at the time of the accident and overlooked at the operation, as noted above. These statistics again strongly emphasize the value of immediate operation in intraperitoneal wounds of the bladder.

TABLE III

CASES OF DOUBLE INTRAPERITONEAL PERFORATION OF THE BLADDER, SHOWING THE KIND OF INSTRUMENT, LOCATION OF ENTRANCE WOUND, OPERATION, AND RESULTS

Instruments	Perineum	Suprapubic	Through Symphysis	No	Died	Mortality	No operated on	Died	Mortality
Sharp Danish Hohlklunge		1		7	3	42.8 per cent	4	1	25 per cent
Blunt Chair leg	1								
Iron picket	1		1						
Lathe	1								
Handle of tongs	1								
Stick	1								

A brief summary of Bartels's cases may be given for the sake of comparison, and, taken together with the above, gives fairly complete statistics for punctured and lacerated wounds of the bladder.

Bartels collected 504 cases of injury of the bladder, classified as follows: punctured wounds, 50 cases, bullet wounds, 285 cases, and rupture, 169 cases. Death resulted in 228 cases, or a mortality of 45 per cent. Of the 504 cases, 131 were intraperitoneal and 373 were extraperitoneal.

Every case of intraperitoneal wound terminated fatally except one, the case of rupture, reported by Walther, of Pittsburgh, in which recovery followed laparotomy, cleansing of the peritoneal cavity, and the use of a retention catheter, without, however, suture of the wound in the bladder. The mortality was, therefore, 99.2 per cent. Of the 373 cases of extraperitoneal wounds, 85 terminated fatally, a mortality of 22 per

cent If we analyze these cases farther, we find the per cent of mortality varied greatly with the nature of the injury, thus for puncture wounds it was 25 per cent, bullet wounds, 15 per cent, and for ruptures, 61 per cent These results are given in the following table, slightly modified, from Bartels

TABLE IV  
INJURIES OF THE BLADDER

Injury	Total	Death	Mortality	Intraperitoneal			Extraperitoneal			Rectum Injury	Bone Injury
				Total	Death	Mortality	Total	Death	Mortality		
Puncture	50	11	22 per cent	10	10	100 per cent	40	1	2.5 per cent	13	
Bullet	285	65	22.8 per cent	27	27	100 per cent	258	38	15 per cent	60	
Rupture	169	152	90 per cent	94	93	99 per cent	75	46	61 per cent	1	131 65

Of the 50 cases of puncture wounds, 20 were produced by blunt and 26 by sharp instruments, while the remaining 4 were gored by animals,—3 by steers and 1 by a bison In 22 cases the entrance wound was in the perineum, 5 were produced by sharp and 17 by blunt instruments Of these 5 cases, 3 recovered, and 2 died from peritoneal injury

In the 17 cases in which the injury was due to a blunt instrument, this entered the anus in 13 cases, and the rectum was perforated in every case In 4 cases the wound entered the perineum, reaching the bladder without wounding the bowel Three of the 13 cases ended fatally, in two of these there was definite involvement of the peritoneum, while in the third the symptoms strongly pointed to that complication

These cases are tabulated by Bartels as follows

The combined statistics then include 75 cases of puncture wounds of the bladder, 15 of these were fatal, a mortality of 20 per cent The most striking feature of these two groups of cases is the great difference in the per cent of mortality in the intraperitoneal wounds In Bartels's series this is 100 per cent, while in the 25 cases which we have collected it is 28.5 per cent This marked diminution in the per cent of fatal

cases is explained by the fact that operative interference was more frequently resorted to, and a relatively large number of cases were saved

TABLE V

TABLE OF PUNCTURE WOUNDS OF THE BLADDER —BARTELS

Instruments	Regio Penneo anal		Obturator for amen		Abdominal		Not stated		Healed		Died		Not stated		Summary	
A Sharp pointed weapons	5		1		19		2		19		8				27	
Lances			1		1				2							2
Daggers		2			4		2		5		4					8
Knives		1			8				5		1					9
Pitchfork					1				1							1
Not stated		2			5				3		3					7
B Blunt pointed	17				1		2		16		3		1		20	
Pitchfork handle		2						1	2		1					3
Chair leg		2			1				2		1					3
Stick—broom handle		11						1	10		1			1		12
Hot iron		1							1							1
Lead pencil		1							1							1
C Animals' horns							3		3						3	
Steer							2		2							2
Bison							1		1							1
Total	22	22	1	1	20	20	7	7	38	38	11	11	1	1	50	50

*Diagnosis*—The diagnosis of injury of the bladder in penetrating wounds of the lower abdomen and perineum is rarely difficult. The escape from the wound of blood *mixed with urine* leaves no doubt that the bladder has been entered. In the majority of cases this sign has been present. The withdrawal of bloody urine by means of the catheter is an equally positive indication that the bladder has been injured. This examination should never be neglected whenever there is a question as to whether or not the bladder has been punctured, and it should be made early. In the case of a wound made by a small sharp instrument, it may be so small as to become effectually closed by a blood-clot, and thus prevent the escape of urine. We may not suspect its depth, unless we catheterize the patient and withdraw urine mixed with blood, and just this class of wounds are the most important, since we are more apt to overlook the gravity of the condition until the extravasa-

tion of urine into the peritoneal cavity or into the perivesical tissues warns us that what we considered so trivial is in fact a serious accident. Mistakes of this kind have happened, and the consequences in some cases have been serious.

After it has been definitely determined that the bladder has been wounded, there still remains the more important question of whether or not the peritoneal cavity has been opened. This is by no means so easily determined, and yet an early diagnosis is of the utmost importance, as the success or failure of an operation may depend upon the time which has elapsed since the receipt of the injury,—the longer this interval the smaller the chances of recovery. Too often in the cases reported this accident has been recognized only after the symptoms of peritonitis have become well defined, or, indeed, in some cases only at autopsy was the true nature of the injury discovered.

In those cases where, following an injury of the bladder, there is prolapse of the omentum, as in the case here reported, or of the bowel, as in one of the collected cases, there can be no doubt as to the peritoneal involvement and the necessity for prompt interference to save the patient's life. Such cases are, however, exceedingly rare. In the majority of cases where doubt exists a positive diagnosis can be made only by an exploratory incision and a careful inspection of that portion of the bladder covered by peritoneum, and such examination should not be delayed. We know that, in rupture of the healthy bladder and extravasation of its contents into the peritoneal cavity, the urine may lie in contact with the peritoneum for many hours without giving rise to symptoms of peritonitis. In puncture wounds involving the peritoneum, however, the danger of infection, carried in by the foreign body, is increased many fold. Symptoms of peritonitis, therefore, are likely to make their appearance much earlier, and are usually much more violent. Hence the necessity for an early diagnosis becomes imperative.

It might be thought *a priori* that the position of the entrance wound would be significant, that the peritoneum is



more likely to be injured when the instrument reaches the bladder through the hypogastrium. This is not borne out, however, by the statistics. Of the ten cases of intraperitoneal wounds in Bartels's list, in at least 50 per cent the entrance wound was in the perineal and sacral regions, while in our list of seven cases there is only one case in which the entrance wound was in the hypogastrium.

Following a laceration of the bladder, if a catheter withdraws only a few cubic centimetres of bloody urine even with repeated catheterizations, and no considerable amount of urine is escaping from the wound, we may strongly suspect that the peritoneum has been wounded, and that extravasation is taking place into the abdominal cavity. Under such circumstances, exploratory laparotomy should be performed at once. In every case of wound of the bladder, when positive signs are absent enabling us to settle the question of peritoneal laceration, we are justified in following the dictum, "When in doubt, explore."

*Treatment*—The treatment to be employed will depend naturally upon the nature of the wound, *i e*, whether it is extraperitoneal or intraperitoneal, or a combination of the two, as in certain cases of double perforation. In extraperitoneal wounds the chief danger to the patient is extravasation, and hence it is against this complication that whatever measures are taken should be directed. The seriousness of this accident is greatly intensified by the fact that the tissues along the track of the wound have been almost invariably infected, and hence rapid and extensive suppuration and destruction of tissue supervene. The essential point in the treatment of these cases is *free drainage*. When the wound is large and permits the free escape of urine from the bladder, there is little danger of this complication. Such a case will generally heal promptly with the usual cleansing and care of the wound and a retention catheter for a few days, or, where this is not well borne, regular emptying of the bladder every three hours by means of the catheter. In a few days the urine will begin to be

voided naturally in increasing amounts, while the escape of urine through the wound will gradually diminish, and finally cease altogether in a relatively short time, and the wound rapidly granulate. In no case has it been found necessary to close the opening in the bladder by operation.

If the track produced by the instrument be small and the escape of urine is insignificant, the wound should be opened up freely by incision, cleansed out thoroughly, and free drainage of the bladder established. Where the wound is so situated that it is impossible or inadvisable to enlarge it sufficiently to allow the free escape of urine, perineal section should be performed at once. This gives perfect drainage of the bladder, thus avoiding the possibility, and even almost certain probability, of extravasation with all its dangerous sequelæ. The puncture wound, thus put into a condition of rest, will granulate rapidly, after which the urethrotomy wound will close readily. Another advantage of this procedure is that it permits a thorough exploration of the wound and the bladder for foreign bodies—pieces of clothing, etc.—which may have been carried in, and which, if not removed, may form the nucleus for the development of a stone, and, later, an operation will be required for its removal. This complication is by no means rare.

*Intraperitoneal Wounds*—A wound of the bladder communicating with the peritoneal cavity is a positive and urgent indication for (1) immediate laparotomy and exposure of the rent in the peritoneum and bladder, (2) closure of the wound by sutures, and (3) removal of the urine, blood, and foreign bodies, if present, from the peritoneal cavity. The details in carrying out this line of treatment will vary with the individual operator, but there is at present among surgeons a very general agreement as to the main points in the treatment as outlined above.\*

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\* It is a curious fact that the idea of suturing wounds of hollow viscera was so tardily taken up by surgeons and put into general practice. This was due undoubtedly to the fact that in the preantiseptic period the open-

The obvious advantages of this procedure are

(1) It permits a careful inspection of the bladder and an examination of the peritoneal cavity for extravasation of

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ing of the abdominal cavity was followed by a frightfully high mortality. The dangers of abdominal section were so great as to deter the boldest from performing this operation for the purpose of the proper repair of laceration of the intra-abdominal organs. In the case of intraperitoneal wounds of the bladder, Sir Benjamin Bell is generally given the credit of having been the first to advise suture of the wound as early as 1789. According to Vincent, Jacob Woyt advised the closing of bladder wounds by sutures long before the time of Bell—as early as 1716. However this may be, it is pretty certain that this procedure was first carried out in man by Willet, "Abdominal Section in a Case of Ruptured Bladder," *St Bartholomew's Hospital Reports*, 1876, vol. xii, p. 209. Willet's case was operated on thirty-six hours after injury. Symptoms of peritonitis were present. Furthermore, the continuous suture which was used slipped. This patient died. The second case, operated on by Heath forty hours after injury, also ended fatally. In this case, also, the suturing was faulty, and extravasation of urine and blood into the peritoneal cavity continued after the operation. This case of Heath precipitated a long discussion before the Royal Medical and Chirurgical Society of London as to the methods of treatment which should be adopted in these cases. There was little unanimity of opinion among the surgeons as to the proper course to be followed. Willet was severely criticised by his confreres for the method which he employed, but he stoutly defended his views, and expressed the opinion that the operation as carried out by him, if performed in time, was the only rational treatment to be employed. Holmes held the same view. Finally, Morris seems to have ended the controversy by declaring in favor of Willet's view as follows: "If the wound is intraperitoneal, employ the method of Willet, that is, immediate laparotomy and suture, if extraperitoneal, cystotomy suffices."

Vincent, in an article in *Revue de Chir*, 1881, gives the result of some important experiments undertaken by him for the purpose of determining the value of immediate suture in intraperitoneal wounds of the bladder. These include puncture wounds, single and double, lacerations, double perforations with bullets, and resections of portions of the bladder. In these experimental cases the wounds were closed by interrupted suture at varying intervals after the injury. From these experiments he concluded that *immediate* operation is essential, the wound of the bladder should be closed by interrupted sutures. In every case where the operation was done early, good results were obtained.

Vincent, calling attention to the fact that Walther, of Pittsburg, was the first and only one who had saved a patient with intraperitoneal wound of the bladder, continued: "His example must be followed with greater confidence since we possess to-day the antiseptic methods of Lister."

blood and urine, foreign bodies, and injuries to the intestines

(2) The wound in the bladder can be tightly closed by sutures, thus preventing the further escape of urine into the abdominal cavity,—in other words, to remove the cause of the mischief. Extravasated urine and blood-clots can also be removed, and a thorough abdominal toilet performed. Injuries to the viscera, when present, may be repaired, thus avoiding the dangers of serious and even fatal complications from this source.

The rent in the bladder and peritoneal covering having been exposed, it should be closed by a row of interrupted sutures. Fine silk is the best material to use. A continuous suture should not be used, as there is danger of its slipping, and the closure is not so perfect. This accident happened in the first two cases in which suture of a bladder wound was employed. A careful toilet of the abdominal cavity should be made, removing the urine and blood, and a thorough search made for foreign bodies. It is safer to drain the abdominal wound for a few days by means of a small gauze wick. A retention catheter should be worn for a few days. This removes the urine promptly, avoids distention of the bladder and pressure on the sutures, and allows the healing of the wound to progress rapidly. In cases of double perforation, where the second wound is extraperitoneal, this should be thoroughly cleansed and lightly packed with gauze.

The statistics for intraperitoneal puncture wounds of the bladder are far from satisfactory, but they are improving, as shown by the tables above. With prompt intervention, the majority of these cases which were formerly invariably fatal should be saved. The same statement is also true of intraperitoneal rupture of the bladder. In a recent article of Seldowitsch, thirty-nine cases of recovery after intraperitoneal rup-

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Under the leadership of Lister, this method has introduced a new era into surgery in general, the surgery of the bladder must not be excluded from its benefits."

ture of the bladder, collected from various sources, are reported

It is only by promptness and thoroughness in our treatment that we can hope that in the future a larger number of these desperate cases will be saved

Since completing the above tabulation, two additional cases have been found and may be added here

1 DOUGLAS, in the *Southern Practitioner*, Nashville, 1894, vi, 13, in a paper on the recognition and management of wounds of the urinary bladder, reports the following case of extraperitoneal wound of the bladder

A boy, aged thirteen years, was seated in an open vehicle, a horse attached to a buggy ran into him from the rear. In the collision he was thrown forward, the shaft of the buggy striking him just to the right of the coccyx. He was rendered insensible. The first complaint was of hypogastric pain and an urgent desire to urinate. Examination under an anæsthetic revealed an irregular circular wound just to the right of the coccyx near the anal margin. The shaft had entered at this point, lacerating the fibres of the sphincter, pushing aside the rectum, and penetrated the base of the bladder. Digital examination showed that the bladder was otherwise intact. The wound was packed with gauze. On the third day there was abdominal tenderness and tympany with a temperature of 102° F. These symptoms gradually disappeared. Healing was rapid, the patient being discharged well in five weeks.

2 In the *St Petersburger Med Wochen*, 1903, No 17, p 29, occurs a brief abstract of a case reported by ARONSTAMM in the *Woensko Medicinski Shurnal*, November-December, 1902, under the title, "Ein Fremdkörper der Harnblase der durch eine Wunde der Blasenwand eingedrungen ist"

The abstract reads as follows. A blade of straw was carried into the bladder by an injury with a pitchfork. By the contraction of the bladder, the straw stuck into the bladder walls, causing marked irritation, frequent urination, and cloudy urine. One end of the straw protruded into the urethral opening. By gentle massage the straw was gradually removed per urethram. The wound in the bladder healed without direct surgical intervention.

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The above list contains the most important articles No attempt has been made to give a complete bibliography References to the cases collected are given in the last table

## SYNOPSIS OF CASES OF PUNCTURED WOUNDS OF THE BLADDER

No	Reporters	Sex	Age	Instrument	Entrance Wound	Prominent Symptoms	Perforation	Operation	Result	Remarks
1	Bench Boston Med and Surg Jour, 1879 c 878	M	16	Portion of window sash	Anus, rectum	Hæmorrhage	Extraperitoneal	None	Recovery in 27 days	Laceration of bladder just above prostate admitted two fingers spread apart half inch
2	Quoted by Beach Patient of Duce, of Slough Boston Med and Surg Jour, 1879 c 878	M	46	Stake driven in to earth	Anus rectum	Intense pain	Extraperitoneal	None	Recovery in 2 months	Laceration in bladder immediately behind prostate
3	Boston Med and Surg Jour, 1879, ci, 738	M	32	Cart stake, 14 in long, 2 in diam at base	Posterior to anus, rectum		Extraperitoneal	None	Recovery in 6 weeks	Bladder wound near neck
4	Treves Med Times and Gazette, 1879	M	23	Sailor's knife	Left buttock Lesser sacroscrotic notch	No symptoms first 12 hours Vomiting Abdominal pain Acute peritonitis	Extraperitoneal	None	Died in 5 days	Extravasation of urine Peritonitis No bladder symptoms
5	Stokes Trans Acad Med, Ireland, Dublin, 1883, i, 88-94	M	16	Handle of forgers' tongs Fall	Anus and rectum	Bloody urine Peritonitis	Double Extraperitoneal Intraperitoneal	None	Death in 74 hours after injury	Pierced trigone and perforation of fundus of bladder to left of median line
6	Jackson Lancet, 1883 i, 231	M	24	Trolley such as railroad porters carry Fall	Rectum	Suprapubic pain Pain in rectum Bloody urine	Extraperitoneal	None	Recovery in 28 days	Rent in bladder 1 inch above prostate Sphincter ani paralyzed and dilated
7	Galler Aertiz Int Bl München, 1884, xxxi, 123	M	24	Knife Stab wound in lower abdomen	Left inguinal canal	Blood and urine from wound Peritonitis	Extraperitoneal Intraperitoneal?	None	Recovery	Retention of catheter Galler thinks wound intraperitoneal but history not conclusive Probably extraperitoneal
8	Pamizo Rev Med de Sevilla, 1886 ix, 97	M	(?)	Incised wound	Hypogastrium, two fingers above symphysis	Bloody fluid from wound Local peritonitis	Intraperitoneal	Cystotomy Suture of bladder and peritoneum, with interrupted catgut	Recovery in 3 months	Large abscess formed about site of wound Wound in peritoneum 6 centimetres long

No.	Author	Age	Weapon	Site	Contents	Diagnosis	Operation	Result	Remarks
9	Livon Marseille Med 1886, xxii, 706	M		Little to left me dian line, 3 cm above pubis	Hæmaturia through wound	Extraperitoneal	None	Recovery in 12 weeks	
10	Forum Rist Romb disc é lett, Rendic Milano, 1888, 2-5, xxi, 700	M	Knife stab	Right genitocrural fold	Bloody urine tenesmus sense of fullness in pelvis, local peritonitis	Extraperitoneal	Suprapubic cystotomy (?)	Recovery	Abscess formed in hypogastrium after healing of operative wound. Complete recovery in about four months
11	Hensgen Deutsche Med Woch, 1893, xix, 592	M	Three cornered file	Through sacrum 10 cm above anus	Localized peritonitis	Extraperitoneal	None	Recovery	Local peritonitis supposed to be due to intraperitoneal wound, i.e., file entered above peritoneal reflexion
12	Bacchi Gazz Med Cremonese, Cremona, 1894, xiv, 2-5	F	Piece of wood from a fall	Right groin	Hæmorrhage from wound	Extraperitoneal (?)	Suprapubic cystotomy, closure of two wounds by interrupted sutures	Recovery in 6 weeks	Phlegmon resulting from infection at time of accident
13	Soulie Marseille Med, 1895, xxvii 164-9	M	Knife thrust entering buttock	Small sciatic notch	Hæmaturia	Extraperitoneal	Suprapubic cystotomy	Recovery	
14	Hamilton Indiana Med Jour, 1895-6, xiv, 229	M	Corn stalk stub	Anus and rectum	Involuntary stools	Extraperitoneal	Edges of wound sutured	Recovery in 2 to 3 weeks	External wound 1½ inches, extending to anal margin
15	Monitor Med, Lima, 1896, xi, 54-56	M	Fell on a piece of cut cane	Anus and rectum, no external wound	Liquid stools with blood and urine	Extraperitoneal	None	Recovery in 2 months	Laceration of Vesicorectal fistula
16	Delageniere Arch Prov de Chir, Paris 1898, vii 240	M	Picket in fence	Perineum left side, 4 cm long from ischium towards root of scrotum	Bloody urine	Double Extraperitoneal	Following morning, laparotomy, suprapubic cystotomy	Recovery in 2 months	Cellulitis in left iliac fossa
17	Alsberg Munch Med Woch, 1898, xiv, 79	M	Iron picket	Inner side of thigh, 10 cm below inguinal fold	Shock	Double Extraperitoneal	Laparotomy 18 hours after injury	Recovery in 20 days	Case unique
18	Dodd Brit Med Jour, Feb 24, 1900	Adult	Bar of iron fall back ward	"Buttock," 2 in above anus	Bloody urine	Extraperitoneal	None	Recovery	Pieces of clothing in wound
19	Gross Rev Med d l'est, 1901, xxviii 487	M	Stake	Perineum Rectum not entered	Absence of symptoms till onset of peritonitis	Double Extraperitoneal	Median laparotomy	Death	Foreign bodies carried into abdominal cavity set up peritonitis. These overlooked at operation



## SYNOPSIS OF CASES OF PUNCTURED WOUNDS OF THE BLADDER—CONCLUDED

No	Reporters	Sex	Age	Instrument	Entrance Wound	Prominent Symptoms	Perforation	Operation	Result	Remarks
20	Weischer Cent f Chir., 1901, xxviii, 127	M	Adult	Scythe, struck by companion in quarrel	Gluteal region. Fo ramen ischiadi cum magus	Blood and urine from wound	Extraperitoneal	None	Recovery	Wound 7 cm long between left pos- terior inf spine ilium, and trochanter Drainage with rubber tube
21	Tuffnell Proc Path Soc., Dublin, vol 19, 512	M	20	Pickfork tunc Fall	Anus and rectum	Bleeding from bowels All urine passed per rectum after injury	Extraperitoneal	None	Died in 5 days	Autopsy Extravasation of urine Prostate split into two equal parts Perineum not injured Local per itonitis
22	Birket Holmes Sur gery	M		Sharp stake driven into ground	Anus and rectum	Intense pain	Extraperitoneal		Recovery	Quoted by Stokes
23	Jawdyński Gaz lek, Warszawa, 1890, 2 s, x, 626-653	M	36	Knife stab in a quarrel	Right buttock	Hæmorrhage from the wound Reten tion of urine	Extraperitoneal	Ligation of ar tery Partial clo sure of wound Drainage	Recovery in 3 months	No complications Wound healed by granulation
24	Rosenbrum Protak Zasaid Kavkazsk Med Obshtsh, 1895, 1890-91 xxvii, 555 564	M	29	Dagger wound	Left inguinal two fingers above Pou part's ligament	Prolapse of bowel Collapse Bloody urine by catheter	Intraperitoneal	Suture of bladder	Recovery in 2 months	Prolapse of omentum and bowel Ex- cision of portion of omentum Ab scess complication
25	Evans	M	18	Fell on slit	Anus and rectum	Shock	Double Intraperi toneal Extraper itoneal	Laparotomy Repair of peri neum	Recovery in 2 months	Omentum protruding from perineal wound Immediate laparotomy su- ture of bladder and later repair of perineum

# DISLOCATION FORWARD OF THE ATLAS, WITH FRACTURE OF THE ODONTOID PROCESS OF THE AXIS

BY JAMES A KELLY, M D,  
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THE high mortality following dislocations and fractures of the cervical vertebræ, the few cases reported in the literature, in which the lesion was only demonstrated to a certainty after death, and the fact that in those cases which survive the condition is not always recognized, leads me to report the following case of dislocation forward of the atlas with fracture of the odontoid process of the axis. The case was observed while I was house surgeon at the Boston City Hospital, on the service of Dr. Hayward W. Cushing, to whom I am indebted for the permission to report this rare and interesting case.

The condition recognized clinically was proven without a doubt by the X-ray photograph, and the case is remarkable by the fact that there were at no time any symptoms of pressure on the spinal cord, that the patient so far recovered as to be able to continue a life of activity, and at the time of the writing of this article (January, 1905), he is able to perform manual labor in spite of the deformity present.

The history in brief is as follows:

C. F., aged forty-seven years, was admitted to the Boston City Hospital, April 17, 1904. The police who brought the patient to the hospital stated that he was arrested while intoxicated, and that on entering a cell he fell, striking his head on a sharp corner, receiving a scalp wound, for the treatment of which he was brought to the hospital. On admission the physical examination showed a man who, while moderately intoxicated, was perfectly conscious. A scalp wound about two inches in length, not exposing the bone, was present over the left parietal region. The head, held rigidly, was in a position of extreme dorsal flexion,

and rotated slightly to the right, the chin being depressed upon the chest. There was moderate muscular spasm of the neck muscles. Over the posterior aspect of the upper cervical vertebræ there was marked swelling and tenderness. No crepitus could be elicited, but through the swollen tissues there could be felt apparent marked prominence of the spinous process of the axis, and there was an increase in the distance from this spinous process to the occiput. The patient complained of considerable pain localized to the seat of the swelling, which was increased on lying down. On this account he preferred the sitting position. There were no symptoms of motor or sensory paralysis. The scalp wound was irrigated and sutured. On account of the local tenderness in the post upper cervical region, and the marked deformity, a clinical diagnosis of probable dislocation forward of the atlas with fracture of the odontoid process of the axis was made, and, in the absence of any symptoms of pressure upon the spinal cord, the treatment consisted in supporting the head with a rigid, well-fitting felt collar, and placing the patient in a semirecumbent position upon a "head rest." On the day after admission an X-ray photograph was taken, which, confirming the clinical diagnosis, showed in the lateral view a well-marked dislocation forward of the atlas (Fig 1). It was thought at the time that, on account of the absence of pressure symptoms, there was probably a fracture of the odontoid process of the axis in combination with the dislocation. The patient being comfortable, and in the absence of pressure symptoms, no efforts were made to reduce the dislocation, the support given by the felt collar being considered sufficient to make the patient comfortable, and prevent any increase in the extent of the dislocation.

April 21. Since entrance the patient has developed no symptoms of pressure upon the spinal cord. He is more comfortable when semirecumbent upon a "head rest," or when sitting up. The collar used at the time of entrance gives perfect support to the head. Examination of the back of the neck shows slight fading ecchymosis and marked diminution in the size of the swelling, rendering palpation of the spinous processes of the cervical vertebræ more easy. Considerable tenderness is present over the swelling. There is apparent marked projection of the spinous processes of the cervical vertebræ from the second downward, which is due to the forward position of the atlas and head,

to the dorsal flexion of the latter, and to the increased distance between the spinous process of the axis and the occiput. There is still moderate rigidity of the neck muscles, the head remains slightly rotated to the right, and, while normal rotation is lessened, it is possible to left and right. Flexion and extension are markedly diminished. The scalp wound is healing by primary intention.

April 25. Local tenderness is still present. There is no change in the extent of rotation, flexion, or extension. There have developed no symptoms of pressure. The sutures were removed to-day from the scalp wound, which has entirely healed. The felt collar is still giving sufficient support to the head.

April 29. The local tenderness is decreasing. There is no change in the bony contour of the cervical vertebræ. Dorsal flexion of the head is still marked. Limitation of motion remains the same as last noted.

May 3. The patient's general condition is much improved. The local condition remains unchanged, excepting that the tenderness has almost disappeared. Yesterday, the patient was allowed to be up in a chair for a short time, and to-day was up in a chair for several hours.

May 7. The patient was allowed to be up and about the ward to-day. All swelling and tenderness of the back of the neck have disappeared. The head is still held in a dorsally flexed position. Anteroposterior movements and rotation are not so restricted, but are markedly diminished. The use of the felt collar is continued.

May 12. The patient has been up and about the ward during the greater part of the day since the last note, and has not complained of any symptoms, either local or general. Examination shows the posterior aspect of the neck and occipital region to be almost a straight line, the normal curve, formed by the junction of the posterior surface of the neck and the occiput, being obliterated. The spinous processes of the cervical vertebræ from the axis to the seventh are in a normal line, that of the axis being prominent on account of its altered relation with the occiput, and the distance between it and the latter being still greater than normal. The head remains in a position of dorsal flexion, anteroposterior motion and rotation are still diminished. The use of the felt collar is continued. The patient desires to go home, and, as there have never been any symptoms of pressure on the spinal

cord, and as he agrees to remain under observation in the outpatient department, he is discharged relieved

Condition of patient, January 18, 1905 The patient states that he has been employed since leaving the hospital His work consists of carrying "pig iron" and other heavy objects He complains of some slight pain in the left side of the neck after doing a hard day's work He has never had any symptoms of motor or sensory disturbances, anæsthesia, or neuritis No difficulty in swallowing

Physical examination shows the head to be held in a slightly flexed position, although the range of flexion and extension is practically normal Rotation to the left is normal, to the right is limited to 10 to 15 degrees from the median line The deformity in the neck still exists The spine of the axis is very prominent Between the spine of the axis and the occiput there is a depression due to the forward displacement of the atlas, the posterior arch of the latter being felt in the depression about one-half to three-quarters of an inch anterior to its normal position Examination of the pharynx shows the posterior wall slightly prominent in the region of the atlas

Since leaving the hospital, the patient has not used any supporting apparatus, and, excepting for the pain occasioned by heavy work, has had no inconvenience as a result of his injury

The X-ray photograph (Fig 1) demonstrates the lateral view of the dislocation It shows that the head is markedly flexed, and that this abnormal flexion takes place at the atlaxoid junction, being due to a dislocation forward of the atlas upon the axis Comparison with the X-ray photograph (Fig 2) of a normal head and neck shows this forward dislocation The line of the anterior surfaces of the bodies of the cervical vertebræ is normally a straight one, from the base of the skull downward, while the X-ray photograph of the dislocation shows that this straight line is abruptly broken at the junction of the atlas with the axis The horizontal planes through the bodies of the cervical vertebræ normally are practically parallel, whereas the X-ray photograph of the dislocation shows that the horizontal plane through the atlas (*c, d*)





forms a marked angle, with the horizontal planes through the other cervical vertebræ (*e, f, g, h*, etc ) The photograph also shows an increased distance between the point *b*, the spinous process of the axis, and the point *a*, the nearest point of the occiput, than occurs normally It also shows that the normal angle formed by a vertical plane through the bodies of the cervical vertebræ and a horizontal plane through the skull is markedly altered (For the purpose of distinctness and explanation, the outlines of the vertebræ and the skull have been made )

On account of the intimate relations existing between the two upper cervical vertebræ and the medulla oblongata, and their position above the roots of the phrenic nerves, and also above those of the other nerves supplying the muscles of respiration, dislocation or fracture of the atlas and axis is extremely dangerous While in all cases the condition is not immediately followed by fatal results, yet the secondary changes which may take place, as hæmorrhage, inflammation, and sudden displacement due to incautious movements, usually produce death The differentiation between dislocation and fracture without the use of the X-ray is extremely difficult, as the symptoms of the two conditions are usually the same In dislocation forward of the atlas without fracture of the odontoid process of the axis, it is to be assumed that sudden death invariably results, on account of pressure on the medulla oblongata by the odontoid process of the axis, and the posterior arch of the atlas When death does not occur, following forward dislocation of the atlas, the odontoid process of the axis must be fractured and carried forward by the unruptured transverse ligament

In studying the anatomical relations between the atlas and the axis, we find that the articulation is formed not only by the lateral articulations as in the other vertebræ, but also by that between the odontoid process of the axis and the anterior arch of the atlas This process is placed vertically behind the anterior arch of the atlas, and is firmly held in place by the transverse ligament of the atlas, by the two alar ligaments which



pass from the base of the process to the occipital bone, and by the vertical extension of the transverse ligament, the suspensory ligament, and the posterior occipito-axial ligament

In forward dislocation of the atlas, the following three conditions are possible (1) A fracture of the odontoid process of the axis, (2) a rupture of the transverse ligament of the atlas, and (3) a slipping of the odontoid process beneath the transverse ligament. If the two latter conditions occur in combination with the forward dislocation of the atlas, the resulting pressure on the medulla oblongata caused by the intact odontoid process and the posterior arch of the atlas will cause sudden death, on account of the resulting space being insufficient to accommodate the medulla oblongata. When the odontoid process is fractured along with the dislocation forward of the atlas, it is carried forward with the anterior arch of the atlas by the transverse ligament, dangerous compression is not necessarily produced, and the condition need not prove fatal if further displacement, compression from hæmorrhage, or inflammation does not occur, and sufficient time is given for repair to take place.

This repair may occur in fracture of the odontoid process as in that of fracture of the other vertebræ, by callus formation, which may remain fibrous or later become bony. If the displacement is not reduced, callus is formed at the seat of fracture, and ultimate union will occur between the fragments in their altered position. After a time the projecting angles and excessive callus become absorbed and ossification becomes complete, so that aside from the deformity the bony parts should become as rigid as before injury.

Figs 3, 4, 5, and 6 are photographic reproductions of anatomical preparations of the three possible conditions that may occur with dislocation forward of the atlas. I am indebted to Dr G G Davis, of the University of Pennsylvania, for the facilities afforded to me in making the anatomical preparations.

*Conclusions*—The diagnosis of dislocation forward of



FIG 3—Vertical anteroposterior section showing normal relations of medulla oblongata, atlas, and axis



FIG 4—Vertical anteroposterior section showing rupture of transverse ligament and pressure on the medulla oblongata by the odontoid process of the axis and posterior arch of the atlas. Posterior atlanto-axoid ligament being ruptured.



FIG 5—Vertical anteroposterior section showing dislocation forward of the atlas with fracture of the odontoid process, the latter being carried forward by the transverse ligament and no pressure being produced on the medulla oblongata. The posterior atlanto-odontoid ligament being ruptured.

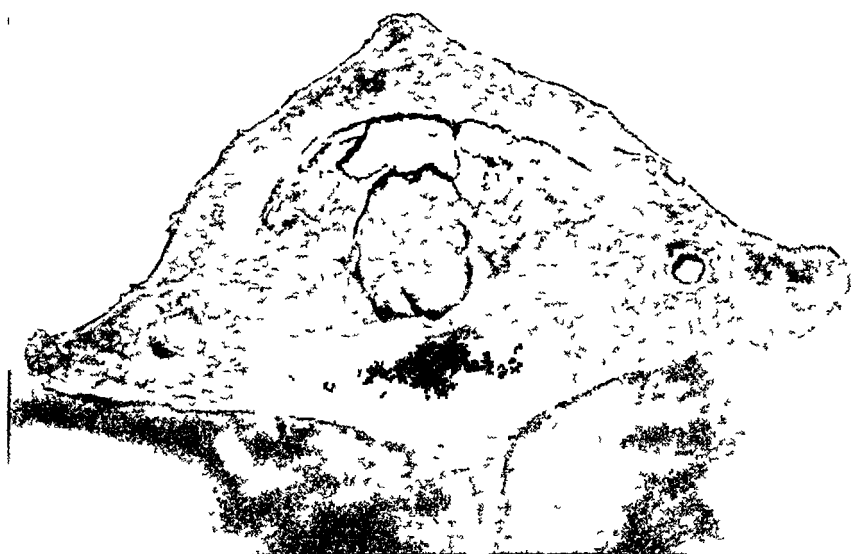


FIG 6—Cross section through atlas showing transverse ligament in front of odontoid process of axis and pressure upon the medulla oblongata by the odontoid process and posterior arch of the atlas

the atlas upon the axis with fracture of the odontoid process of the latter, in this case, is based upon the following

(1) The history of injury and the clinical symptoms demonstrated the condition

(2) The X-ray photograph demonstrated the dislocation

(3) The absence of pressure symptoms prove conclusively that a fracture of the odontoid process must have been present in combination with the dislocation

(4) The anatomical preparations show that pressure upon the cord would have occurred unless the odontoid process had been fractured

# A NEW INTERDENTAL SPLINT FOR FRACTURES OF THE LOWER JAW

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LOOKING over the many forms of interdental splints which have been proposed for the treatment of fractures of the lower jaw, we find that they may be roughly grouped into the following four classes

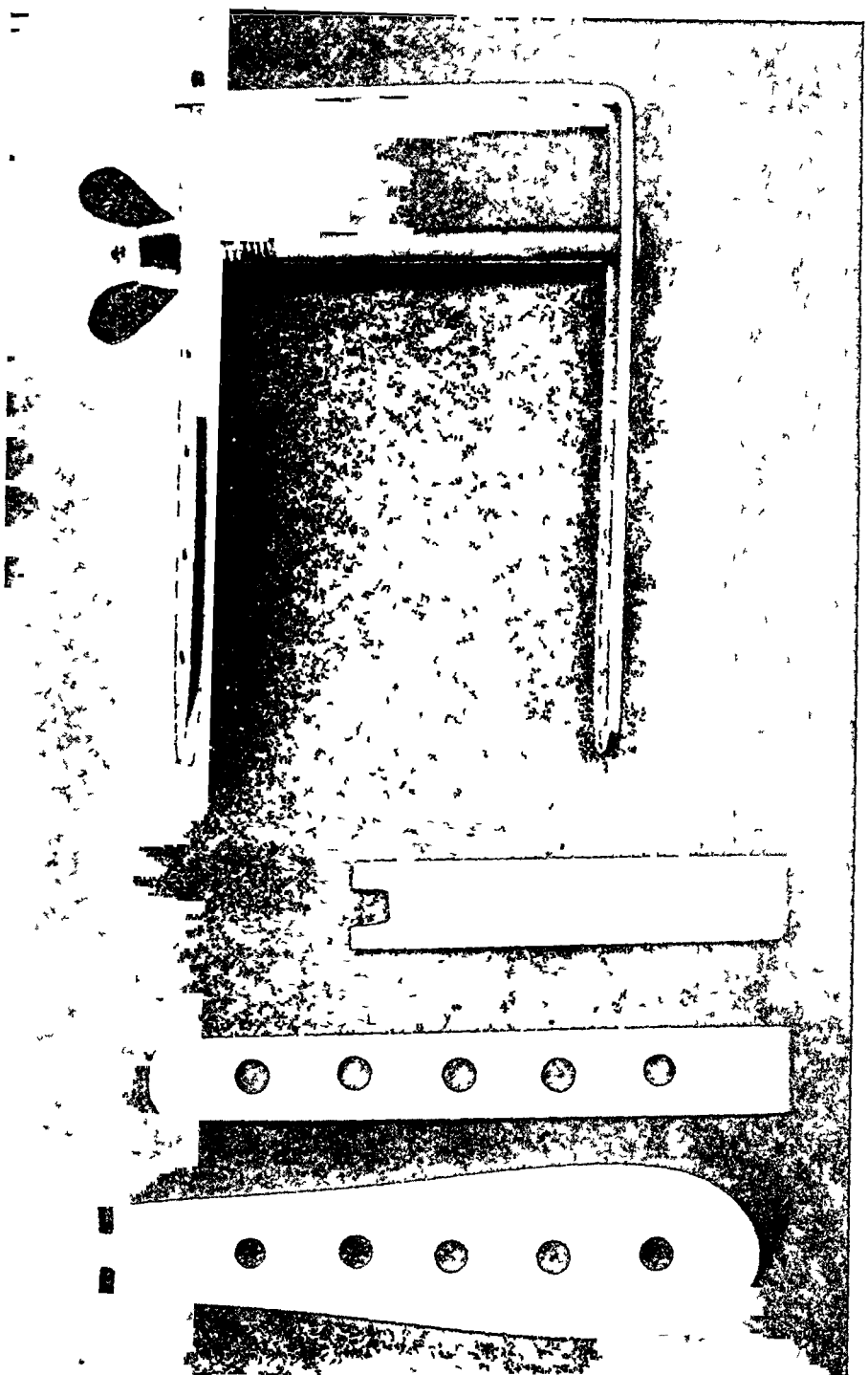
1 Those in which support is derived from the upper and lower teeth, the apparatus fitting as a wedge between them, as in the splints proposed by Lederer, Fuller, Ottolengui, and others

2 Those in which reduction is maintained by a single splint fastened to the lower teeth as in the methods of Angle and Lohers, or the interdental wire splints of Hammond, Sauer, Claude Martin, of Lyons, or a silver clasp over the crowns of the teeth as employed by Mutter, or steel plates fitted along the anterior and posterior curvatures and retained by a steel clasp as proposed by Nicole

3 Those in which an interdental plate is held in position by straps, attached to long arms projecting from the plate, as in the apparatus of Kingsley, Gunning, Marshall, and Truman

4 Those in which there is both downward (interdental) and upward (chin) pressure, as exhibited in the splints of Wales, Sudduth, Lonsdale, Bullock, Moriarty, Ackland, and Matas Such splints are far to be preferred, for they hold the fractured parts much firmer than the other methods mentioned

But, as we look over the field of fracture work, we can find hardly a single appliance among the elaborate ones which have been proposed which is still in general use Nearly all have been relegated and clinical methods of work have taken their places This is especially true of the various pieces of



The Clamp

Short  
Arm

Long  
Arm

Chin  
Piece

FIG 1.—The clamp and its parts (natural size)





apparatus for fracture of the mandible Many of them have been applied successfully by their originators, but have never been generally accepted Some require a skilled dentist for their application, making them impracticable for clinical work, and thus greatly limiting their field

It has seemed to me that a splint for this fracture, in order to obtain the greatest degree of usefulness, should fulfil the following requirements

It should hold the fracture with absolute firmness It should allow of free use of the lower jaw so as not to interfere with speech or the taking of food It should not so cover the teeth as to prevent free cleansing of them with antiseptic solutions, for, as these fractures are very likely to be open, oral sepsis is the greatest danger which confronts the surgeon The splint should be readily accessible to any practitioner doing surgical work He should be able to make it, if necessary, with the materials at hand, combined with such mechanical assistance as any small town or hamlet may afford He should be able to apply the splint, if necessary, without professional assistance As it is not possible in many cases for the patient without force to open his jaws but a slight way after the receipt of the injury, thus preventing the taking of impressions or the moulding of a mouth-piece, the splint should meet this need It should be worn with comparative comfort, and should not become loosened when the patient assumes his usual sleeping attitude It should be capable of quick removal for purposes of inspection and rapid readjustment

The apparatus which I am about to describe meets these requirements It cannot be used in all cases of fracture of the lower jaw It is out of the question in fractures of the rami or of the condyloid or coronoid processes, or in those cases of severe comminuted fractures such as are met with in railway surgery or in gunshot injuries Looking over my records, I find, however, that I could have employed it advantageously in about 90 per cent of my cases

This splint is made of spring brass  $\frac{3}{64}$  of an inch in thickness and shaped as shown in the accompanying illustration

(Fig 1) Each clamp consists of two parts, a chin-piece and a piece bent at right angles, making a long and short arm. The chin-piece is wider at one end to prevent its slipping when incorporated into the plaster-of-Paris dressing. It is 8 centimetres long, and provided with a number of holes so that the plaster-of-Paris may sink into them, thus making the dressing more secure. The right-angled piece is 1 centimetre wide, while the arms measure  $7\frac{1}{2}$  centimetres and 5 centimetres respectively. The end of the short arm is provided with a simple lock which fits into a corresponding lock in the chin-piece. Three or four holes should be bored into the long arm.

When these two parts are locked, they form a clamp which permits of easy adjustment. This adjustment is accomplished by means of a round head brass machine-screw 6 centimetres in length and carrying a winged nut. This fits into holes in the long arm and the chin-piece at  $1\frac{1}{2}$  centimetres distance from the short arm. Such a splint is easily and quickly constructed by any gunsmith or locksmith. After the clamp has been made, it should be heavily nickel plated. The making and plating of the splint will require one day. The clamp as above described has been found to be applicable to thirty-five out of fifty adult jaws. For the other cases, a splint with a short arm of  $5\frac{1}{2}$  centimetres answers.

In the absence of proper material, the following plan may be adopted. Tool steel of 12 centimetres width is employed. This is shaped as above described, with the exception that the chin-piece is of the same width throughout its extent. If the screws and nuts are not to be obtained, the parts can be fastened together with wire. The apparatus is clumsy in appearance, but answers the purpose very well. I employed it with excellent results in my first case.

The splint is applied with the patient lying in the dorsal position upon the operating table. The face is cleanly shaven and the fracture reduced. A thin layer of felt or layers of sheet wadding are then fitted neatly over the chin and under the jaw, extending as far back as the ramus. Over this a plaster-of-Paris bandage is carefully folded, the operator rubbing the



FIG 2 —The interdental splint in position



plaster well in as he proceeds. The bandage is carried back on each side to the ramus, where the turns are held by an assistant or by the patient. When the jaw is well covered the splints are applied, the parts being held together by the screws and nuts. The long arms are placed directly over the molar and bicuspid teeth, extending as far back as the last molars and emerging at the corners of the mouth. The chin-pieces are pressed into the plaster. They should run along the body of the jaw. The apparatus being in position, a few more turns of the bandage are taken and the dressing completed by rubbing in dry plaster-of-Paris. Accurate coaptation is desired.

When dry, the chin-pieces are detached from the interdental portions and the plaster-of-Paris dressing removed and trimmed to the desired shape. The dressing is then reapplied to the jaw. The interdental portions of the splints, together with some dental compound, such as is commonly used by dentists in taking impressions, are thrown into hot water. When sufficiently softened, the dental compound is applied along the under surface of the interdental arms, and these are quickly placed upon the teeth, in the same position as in the first application, and pressed firmly down so that the splints rest upon an even bed, the dental compound filling up the holes which have been bored into the long arms. The short arms are then locked to the chin-pieces, the screws reapplied, and the apparatus tightened by means of the winged nuts.

The application of the apparatus requires but little skill, and can easily be done with no other assistance than that which the patient can furnish. If properly made, uniform pressure will be exerted by the plaster-of-Paris cap and no excoriations of the skin will result. By means of the action of the two parallel lines of force, each splint holds its half of the mandible as in a vise, while spreading is prevented by the closely fitting plaster-of-Paris dressing (Fig. 2). Firm pressure upon the molar teeth, so necessary in the treatment and in the retention of the apparatus, is exerted. My first case was one of open fracture between the right canine and the second incisor in which great mobility existed. The fracture, after being in-

effectually treated for six weeks by other methods, was firmly united after this splint had been in position three weeks. The apparatus furnishes a quick and ready method of treatment, and my experience with it thus far has been most satisfactory. In one instance I applied the splint to a most irregular set of teeth. As in these cases there is danger of the apparatus loosening, allowing the long arms to slip off the molars, it will be best to so construct the splint as to leave several tabs projecting from the long arms. These can be turned down at right angles, thus making the dressing perfectly secure.

In conclusion, I desire to express my thanks to Professor Harry M. Sherman, head of my department in the University of California, for valuable advice and for the clinical opportunities for study which he has given me, also to G. Edward Luce, an expert mechanic, who has been of the greatest assistance in working out the details of this splint.

# THE TREATMENT OF FRACTURES OF THE FEMUR IN INFANCY AND CHILDHOOD

BY MARTIN W WARE, M D ,

OF NEW YORK,

Adjunct Surgeon to Mt Sinai Hospital

FRACTURES of the femur that we encounter in infancy are those produced *inter partum* by the accoucheur, and those in nurslings, the former the result of indirect violence during delivery, and the latter very commonly met with in rhachitic infants who sustain a slight fall or blow. Here we have to deal with indirect or direct violence as causative factors. The same holds good for children when once they are able to walk.

In the infant in arms pain, great tenderness, and slight deformity attract attention to the fracture, which at this tender age is most commonly incomplete and of the greenstick variety. In the child able to walk, the deformity may be more marked, being decidedly angular at times and associated with false motion and crepitus. The line of fracture under these circumstances is generally transverse, consequently there is no overriding of the fragments. The angular deformity which alone accounts for slight shortening is caused by the action of the muscles, which are best made to relax by flexing the thigh and leg.

This principle of flexion of the thigh and leg is made use of in the Hodges, the Smith splint, Dunham's splint, the double inclined plane of Volkman, and the vertical suspension of Schede (Hamilton). Of these the last is widely employed in fractures of the thigh in children and yields excellent results. It, however, necessitates confinement to bed, wherefore it is a more common practice to treat infants and children with a plaster-of-Paris spica embracing the thorax and extending half-way down to the leg, or using a Nélaton splint. The weight of such an extensive plaster-of-Paris dressing, while it absolutely immobilizes the fragments, makes it difficult to carry the



infant or child about, hence it is incumbent to place the little patient on his back in bed. Furthermore, free breathing is embarrassed by reason of this constant recumbent position and envelopment of the thorax with the plaster-of-Paris or the lateral splint. With the thigh in extension the toilet of the child is nigh impossible.

The disadvantages of the various splints above enumerated are offset by the use of the device about to be described, which I have used in my service at the Good Samaritan Dispensary in forty cases up to the age of five years, and on two occasions in fractures of both femora (Fig 2), always attended with excellent results.

The accompanying illustrations (Figs 1 and 2) will best convey the idea of the apparatus. The device consists of a right-angled isosceles triangle constructed of one strip of book-binder's pasteboard, the width of the triangle adapted to the width of the thigh. One length is obtained by measuring the trunk from the level of the lower angle of the scapula to the inguinal fold. The length of the other side of the right angle is the length of the thigh. The hypotenuse is always a few inches longer.

The single strip of cardboard is then bent to the shape of the desired triangle and the overlapping edges secured by adhesive plaster. The triangle may be made more rigid by reinforcing it on all sides of this inner aspect with small pieces of cigar-box wood. The outer surfaces in contact with the trunk and thigh are to be padded with non-absorbent cotton. A muslin spica secures the triangle embracing the trunk and the thigh in a flexed position. Over the muslin bandage several turns of a dextrin bandage are placed, giving additional security to the splint. The leg is left to move freely.

It is surprising how comfortably the infants may be carried about, how clean they may be kept during the three to four weeks that the splint is kept in place, and how uniformly successful the perfect healing of the fracture results.

In conclusion, I wish to assign credit for this device to the late Dr W W Van Arsdale, whose experiences therewith



FIG 1.—Combined pasteboard triangle and plaster-of-Paris spica apparatus for fracture of femur in infancy



FIG 2 —Apparatus for treatment of fracture of both femora

were first made public in 1897 (*Journal of the American Medical Association*, vol xxix, p 1239) This confirmation of his experiences it is hoped will give an impetus to this very valuable method of treating fractures of the femur in infancy and childhood, which has an economic value in permitting the nursing of an infant and doing away with four weeks of recumbence in bed whether in hospital or at home

# FRACTURE OF THE CARPAL SCAPHOID

BY LEONARD W ELY, M D,

OF NEW YORK

THIS injury, formerly thought to be very rare, since the introduction of the X-ray appears to be of fairly frequent occurrence The account of another case follows

The patient, a telegraph lineman, thirty years old, presented himself for treatment at the Roosevelt Hospital Dispensary on June 20, 1904, and gave this history Four weeks previously he had fallen from a telephone pole to the ground, striking on his left hip and wrist He was carried to the hospital and presumably was treated for contusions by rest in bed for two weeks Since then he has limped, and has had pain in his hip, and pain and disability in his wrist He applies for treatment for his wrist

Examination showed thickening of carpus and inability to flex or to extend the fingers Passive extension of the middle finger was especially painful and difficult Motion at the wrist-joint and supination of the hand were restricted

A skiagram was taken, and some passive motion was done The course of the case appears in the record

June 21 Skiagram shows fracture of scaphoid and displacement of the carpus towards the radial side The semilunar also appears to be displaced Treatment, strapping

June 23 Strapping removed Daily massage and gentle passive motion prescribed

July 12 Slight improvement Strapping

July 19 Strapping removed Motion in fingers has slowly improved, but wrist is still very stiff Ichthyol ointment and hot and cold water

July 21 Under ether adhesions were broken up, and the wrist was moved as much as possible Evident bony resistance to extremes of motion Patient ordered to use hand

July 22 Considerable reaction

At this point the notes cease The patient has disappeared and cannot be found The treatment must be put down as unsat-

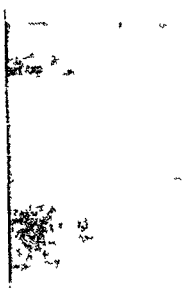


FIG 1—Fracture of the cupal scaphoid bone  
of left wrist the injured side



FIG 2—Skiaograph of the right uninjured wrist, to be com  
pared with Fig 1



isfactory, but the case seems to show the necessity for early reduction of the deformity

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# TRANSMESENTERIC HERNIA OF THE APPENDIX VERMIFORMIS<sup>1</sup>

BY ALFRED C WOOD, M D,

OF PHILADELPHIA

A MALE, aged twenty-two years, student, was admitted to the University Hospital, January 7, 1904. He had always enjoyed good health, with the exception of two occasions, viz, the first, four years ago, when he had an acute attack of obstinate constipation and generalized abdominal pain, lasting several days and causing him to remain in bed, the second was a similar attack, nine months before admission to the hospital, associated with influenza and lasting ten days.

About two weeks before the present illness the patient was writing almost all day, and he found, while sitting at the table, that he was comfortable only when the right side was "kinked up," as he expressed it. In this position he did not feel any unusual sensation, but as soon as he assumed a normal posture he was conscious of a distress in the abdomen. Without any other premonitory symptoms he became distinctly ill on the afternoon of January 1, about a week, therefore, after the attack just mentioned. He had headache, nausea, vomiting, and moderate pain in the epigastrium. After retiring in the evening he had a pain in the back and felt chilly, but had no distinct rigor. On the following day there were three bowel movements, the pain in the abdomen continued. There was no definite change on the third day, the bowels moved once. On the fourth day the pain was distinctly in the right lower quadrant of the abdomen. It had been continuous with occasional attacks of general abdominal pain. There was no change on the fifth and sixth days. On the seventh day, after saline purges, there were six watery stools.

The notes made on January 8 are as follows. Pulse, 88, respiration, 20, temperature range 100° to 102<sup>2</sup>/<sub>5</sub>° F. The abdomen is not distended, and there is no rigidity. A rounded tender mass is felt in the abdomen, approximately two inches wide and

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<sup>1</sup> Presented before the Philadelphia Academy of Surgery, April, 1905



FIG 1—Hernia of appendix vermiformis through abnormal opening in mesentery with strangulation. A, The free extremity of the appendix, P the cecal extremity, the arrow points to the perforation indicated by the small dark spot. The crown composed of lymph, covers the portion that had protruded through the mesenteric opening.



four inches long, in the line of the ascending colon, the lower border of the mass corresponding with McBurney's point The leucocyte count is as follows January 8, 2 P M , 14,640, 9 P M , 17,920, midnight, 17,000, January 9, 9 A M , 16,080 The urine is normal

Although some of the features were unusual, the condition was thought to be appendicitis, with an abscess An operation was performed, the peritoneal cavity being opened by an incision over the mass The latter occupied the normal position of the ascending colon and had the general shape and size of this structure It was firm to the touch and had a very deep red color At three or four points areas of softening were seen, suggesting the beginning of breaking down in the mass While no anatomical structure could be recognized through the incision, the mass was thought to be the colon, altered by inflammatory action and lymph formation As the appendix could not be found, it was supposed to be in the mass described, but a careful search failed to disclose a trace of this structure The areas of softening were found to be suppurating, epiploic appendages By enlarging the incision the survey was extended, and finally the cæcum recognized firmly fixed in its position The longitudinal bands could be seen here, but were obscured above The anterior band led backward and upward, and seemed to be lost beneath the mesentery On inspecting the opposite surface of the latter, after displacing a portion of adherent omentum, a small rounded structure was seen projecting from it The condition at once became clear, the appendix had slipped through a hole in the mesentery and had become strangulated It was reduced with some difficulty, owing to adhesions and the firm constriction of the ring As soon as the appendix was liberated the unusual fixation of the cæcum was relieved The process was removed The opening in the mesentery, which comfortably admitted the tip of the little finger, was closed by sutures A Mikulicz drain was inserted and the wound closed The patient made an uncomplicated recovery

As will be seen by consulting the illustration, the appendix was strangulated at its base, the organ having doubled upon itself and slipped into the hole in the mesentery It had ruptured at the point of constriction The meso-appendix was unusually large and fleshy

In addition to the rarity of the condition, the case was inter-

esting on account of the presence of an inflammatory mass quite two inches from the affected portion of the appendix, and an apparently healthy area between. This misleading evidence prolonged and complicated the operation. The minute perforation of the appendix permitted very slow leakage, which, owing to the position of the patient, or other causes, collected on the anterior and outer aspect of the colon, and caused an inflammation of the structures with which it came in contact.

I have not been able to find any reference to similar cases, although instances of strangulation of the intestine in the same manner are recorded.

# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY.

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*Stated Meeting, March 22, 1905*

The President, HOWARD LILIENTHAL, M D , in the Chair

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### HYDRONEPHROSIS, WITH COMPLETE DESTRUCTION OF KIDNEY PARENCHYMA DUE TO CALCULOUS OCCLUSION OF URETER, NEPHRECTOMY

DR CHARLES N DOWD presented a woman, forty-nine years old, who had always enjoyed much better health than the average, had borne two children, and had attended to the ordinary duties of her household

On admission to the General Memorial Hospital, in May, 1904, she looked vigorous and well-nourished, and said that she had felt particularly well and strong for the past few months. She felt, however, the mechanical presence of a large mass in the left side of her abdomen. On close questioning, she said that for years she occasionally had had a little backache and slight pain in the left iliac region. This mass proved to be a uronephrotic kidney sac, which was removed without difficulty, and with no constitutional after-effects nor wound complications. No kidney parenchyma could be found. The ureter of the kidney was occluded by a calculus which had been eroded in spots, apparently by chemical action. It seemed remarkable that a kidney could have been dilated so as to have its parenchyma entirely destroyed, and that its ureter could have been completely occluded without giving rise to sufficient symptoms to call the patient's attention to her condition. The process must have been gradual, the urinary flow having been hindered but not completely stopped,

during the early stage of the condition The cyst was nine inches long

#### PAINLESS HÆMATURIA OF FIVE YEARS' DURATION, INCISION OF KIDNEY PELVIS, CESSATION OF SYMPTOMS

DR CHARLES N DOWD presented a man, aged forty-nine years, who had enjoyed good health until nine years ago, when he began to suffer from painless hæmaturia This persisted for two years, then, after ceasing for four years, it recurred, and had been continually present for the past three years He had suffered from weakness, and had shown much pallor from the loss of blood, otherwise, there had been no symptoms, and he had been able to do light work most of the time

When the patient came under observation on February 7, 1905, he passed a specimen of urine which appeared to be about one-fifth blood Its color was deep red It was submitted to Dr Frederic E Sondern for examination, who reported that it was acid, with a specific gravity of 1027, it contained about the amount of albumen which the blood would account for, no casts, tubercle bacilli, or cellular elements referable to the kidney could be found There were a few bladder-cells, crystals of oxalate of lime, and a normal percentage of urea

The patient stated that he had submitted to many forms of treatment without benefit The hæmaturia was usually less when he was resting An X-ray examination was negative The cystoscope showed bloody urine coming from the right ureter There was a projection at the right ureteral orifice which prevented the introduction of the catheter The bladder was otherwise normal, the urine from the left ureter was clear

Exploration of the right kidney and ureter was made February 11 through an oblique lumbar incision The kidney was brought well through the wound so as to expose its surface and the upper part of the ureter An opening was made into its pelvis, but this showed no evidence of blood nor other abnormality The finger introduced into each calix failed to detect a stone or anything abnormal A catheter was easily passed downward into the bladder The wound in the renal pelvis was sutured with catgut, and the kidney secured in position only so far as stitches in its fatty capsule would hold it The capsula

propria was not incised. The patient's recovery was uneventful, and he had not suffered from hæmaturia since. The urine still contained a trace of albumen and a few hyaline casts. The amount passed in twenty-four hours was 1110 cubic centimetres, specific gravity, 1017, it contained 17,338 grammes of urea, and an excess of indican.

Cases of this kind, Dr Dowd said, were hard to explain. There was an extensive literature on the subject. Schuller, in reporting a somewhat similar case in the *Wiener klin Woch*, last year, carefully reviewed the subject, and maintained that there were practically always lesions in the kidneys from which these hæmorrhages came, although the lesions might be so small that they could not be detected by the naked eye. In his case he found evidences of an old inflammatory process in the kidney. In the cases he reviewed, there were, with two exceptions, evidences of inflammation of certain parts of the kidney or its capsule, or mechanical, congenital, or calcareous lesions.

Fenwick, in his monograph on "Ureteric Meatoscopy," had also considered the subject in detail. In addition to the presence of stone, of tubercle bacilli, or a malignant growth, which of course at once suggested themselves as possible causes of this condition, he referred to chronic granular nephritis and angioma or capillary nævus of a renal papilla as causes. The former, he stated, have constituted about 12 per cent of his cases of painless hæmaturia, but, owing to the great admixture of blood, the casts and other evidences of chronic nephritis had usually not been discovered. He had never encountered a case in which both kidneys bled simultaneously. He also cited six cases of angioma of a papilla that caused the hæmaturia, and advised in such cases the removal of the papilla or the destruction of its blood-supply by rough tearing of that particular pyramid through a cortical incision.

Dr Dowd said that nephrotomy and nephrectomy had been frequently done for painless hæmaturia. In the case he had shown, the bleeding seemed to be due to a chronic nephritis which was now showing itself in the presence of albumen and hyaline casts.

DR JOHN A HARTWELL mentioned the case of a man, fifty-two years old, who, after he had been in the Lincoln Hospital for some time for chronic rheumatism, developed a severe hæma-



turia Examination of the urine failed to show any evidences of nephritis In the course of a few days the bleeding subsided, but there was a subsequent recurrence, and this was rapidly followed by the development of a large tumor in the region of the left kidney He had no temperature The leucocyte count was 22,000 An incision in the left lumbar region opened into a large hæmatoma apparently surrounding the kidney On account of the severity of the hæmorrhage, a nephrectomy was done A gross examination of the kidney showed small hæmorrhagic spots After the operation, the patient was apparently progressing satisfactorily until the eighth day, when he had a profuse hæmorrhage from the wound, and died The autopsy showed a large collection of blood in the postperitoneal region The excised kidney was submitted to Dr W A Ewing, whose microscopical examination of the organ failed to show any evidences of nephritis or throw any light on the cause of the hæmorrhage There was nothing to show whether the blood came from the kidney or outside of it

DR HOWARD LILIENTHAL said he had published elsewhere a case bearing on the subject under discussion (hæmorrhagic nephritis) The patient was a woman who was suffering from profuse hæmaturia A suprapubic cystotomy was done, which showed that the blood came from the right ureter A nephrotomy was immediately done, and the hæmorrhage checked by introducing a catheter into the ureter The woman died as the result of the excessive loss of blood, and a very minute post-mortem examination of the entire urinary tract failed to show the source of the hæmorrhage There were evidences, however, of a nephritis, and the case was apparently one of hæmorrhagic nephritis Dr Lilienthal said that cases were not uncommon where a hæmaturia had apparently been cured by a simple nephrotomy

#### OSSIFYING SARCOMA OF THE THIGH, TREATMENT BY INCISION, RADIUM, AND EXTIRPATION

DR HOWARD LILIENTHAL presented a girl, twenty-one years old, who early in 1904 noticed a mass about the size of an egg in the upper part of the right thigh, to the outer side of Scarpa's triangle It was neither painful nor tender, and did not interfere

with locomotion. It steadily increased in size, and the patient applied for treatment at Mt Sinai Hospital on November 9, 1904.

The patient's family history was unimportant, beyond the fact that her mother had been operated upon at the age of twenty for the removal of a tumor of the shoulder.

On examination, the girl was found to be in apparently good general condition. The tumor of the thigh was roughly ovoid in shape, about four inches in its shortest diameter and six inches in its longer, which was parallel with Poupart's ligament. It was rather larger than a coconut, was in the main elastic, perhaps cystic in consistency, with here and there firmer masses. There was no pulsation, and no palpable lymph-nodes in the neighborhood. The skin was of a normal color and texture, and was not adherent. Very slight tenderness could be elicited on pressure over the median and lower portions of the growth. While the tumor could be moved about with some freedom, it seemed to be firmly attached in its deeper portion, probably by a pedicle or band to bone or periosteum. Had this been the case, a hip-joint amputation would hardly have promised a radical cure because of the extensive involvement of the soft parts.

On November 11, 1904, the tumor was aspirated, and bloody fluid withdrawn. Free incision then revealed that its contents were partly fluid and partly soft and encephaloid, while in the walls there was considerable bone in thin plates, making the diagnosis of osteosarcoma sufficiently probable to forbid further interference at that time. Accordingly, after a rough curettage, the partly collapsed tumor was packed and the incision sutured, with generous gauze drainage. The fluid evacuated from the cystic part of the tumor was submitted to Dr A Bookman, the physiological chemist, who reported as follows: "Blood did not clot on standing for two weeks. Thirty cubic centimetres gave 0.0148 gramme  $\text{CaSO}_4$ , equivalent to 0.375 per cent  $\text{Ca}(\text{PO}_4)_2$ . This was about the normal calcium phosphate contents of the blood. The non-coagulability was therefore due to the presence of some substance destructive to the fibrinogen ferment, or to the lack of the ferment itself." A blood examination showed 7400 white cells, and demonstrated the absence of nucleated red cells.

The pathological department of the hospital reported that Dr F S Mandlebaum had found the structure of a spindle-

celled sarcoma in the solid portion of the tumor, and that the bone plates showed nothing abnormal

The patient reacted well after the operation, and the oozing, which was at first quite profuse, steadily diminished. A few days later, following the experience of Dr Robert Abbe, a tube of radium of 300,000 activity was covered with a sterile finger-cot and inserted into the cavity of the tumor, and allowed to remain there for six hours. Suppuration, with slight elevation of temperature, followed, although there had been no infection before. Whether this suppuration was the direct result of radio-activity or of the possible introduction of some infective agent with the radium tube, it was impossible to say. The radium was employed in this manner at intervals of four to six days, and there was a rapid shrinkage of the tumor, until by January 1, 1905, it had been reduced to the size of a small adult fist, and had become so freely movable that its excision was determined upon. On January 6, in spite of the presence of suppuration, the tumor was dissected out. It was then seen that the growth had no connection with the femur, but had sprung from the quadriceps and the fascia lata. The extirpation was apparently thorough. Suppuration naturally followed, but with free drainage the case never assumed a threatening aspect, and recovery was now practically complete. The tumor was carefully examined after its removal, and the diagnosis of spindle-celled sarcoma confirmed. The neoplasm contained absolutely no bone.

Since the extirpation, Coley's fluid had been injected into the tissues near the cicatrix, the preparation used being that of Parke, Davis & Co. Seven injections, ranging from a quarter of a minim to nineteen minims, were given, and it was hoped that this treatment might prevent a recurrence. A reaction followed each injection.

This case, Dr Lilienthal said, presented two interesting clinical points. First, as to the prognosis and operability, and, second, as to the error of diagnosis even after exploratory operation. The tumor at first seemed absolutely inoperable, excepting, perhaps, as a piece of surgical pyrotechnics, with resulting terrible mutilation of a young girl, and, even in the event of an operative recovery, the great probability of rapid recurrence. By the incision and drainage of the mass, together, perhaps, with the action of the Becquerel rays, shrinking to a point of easy oper-

ability occurred, and, even though there was still the possibility of metastasis and recurrence, the state of the patient was far better than it would have been with the major operation

As to the second point, incision and careful exploration of a tumor within easy reach should yield a good anatomical and pathological diagnosis. Yet here, owing to the presence of the bone plates, he was led to believe that the femur must be involved. The final result, however, showed no connection with the bone nor with any structure near the bone. The neoplasm then must have been a true ossifying sarcoma.

### ANEURISM OF THE RIGHT SUBCLAVIAN ARTERY

DR LILIENTHAL presented a man, forty years old, who was admitted to Mt Sinai Hospital on February 4, 1905. His family history was negative. He had had occasional attacks of rheumatism during the past ten years, and for the past year or two he had at times felt slight shooting pains in the præcordial region. He denied gonorrhœa and syphilis.

In December, 1904, the præcordial pain became more severe, radiating to the right shoulder and down the right arm. Shortly after this a swelling was noticed in the right supraclavicular region. The right hand, especially the finger-tips, became much swollen, with a sensation of pins and needles pricking it.

Upon examination, the supraclavicular mass proved to be about the size of a duck's egg, but globular in shape, and with an expansile pulsation. It was situated in the course of the second portion of the subclavian artery. A systolic thrill could be felt over the tumor. The overlying skin was normal and the clavicle was not involved.

On February 8, 1905, a ligation of the first portion of the right subclavian and the common carotid was done. An incision was made along the right clavicle, the skin-flap dissected upward and outward, the external jugular vein and all superficial vessels ligated, and the sternal origin of the sternocleidomastoid muscle divided. After freeing the clavicle, its inner half was resected. The first portion of the subclavian and the first part of the common carotid were exposed, their sheaths opened, and both were secured by temporary chromic gut ligatures. Upon tightening these ligatures, no pulsation could be felt in the aneurismal sac,

which was then opened by a transverse incision. The bleeding following this was very profuse, a jet of blood about four inches high spurting from it in a steady non-pulsating stream. The hæmorrhage was easily controlled by inserting a finger into the sac, and upon palpating the latter it was found that it had no opening on its cardiac aspect, but there was a very large one in its distal portion, proving that it was an aneurism of the sacculated variety. The finger was thereupon withdrawn from the sac, and the incision into it closed with chromic gut sutures. The two ligatures that had been temporarily placed on the common carotid and the first portion of the subclavian were then made permanent by the Ballance and Edward's method of tying, and the wound drained and closed.

The patient made a rapid and uneventful recovery, and no unfavorable symptoms followed the operation. Pulsation had never reappeared in the aneurism, which had now almost shrunk away. There was slight pulsation in the right temporal and carotid, but no pulsation in the right radial. The patient was kept in bed until March 2, twenty-two days after the operation, and was then allowed to sit in a wheeling-chair. He had gradually returned to walking, but no exertion of any kind had been permitted.

#### EXCISION OF CARCINOMA OF THE ANAL PORTION OF THE RECTUM

DR BENJAMIN T TILTON presented a woman, forty-five years old, who had suffered for six years from piles and fissure. For five weeks before her admission to Bellevue Hospital she had suffered very severely from pain in the rectum, especially at defecation, constipation, and bloody stools. She had become considerably emaciated, largely owing to the intense pain.

Examination showed an ulcerating tumor, about the size of a silver dollar, on the posterior circumference of the rectum, in the vicinity of the sphincter. The glands in the groin were not enlarged.

Operation, September 29, 1904. This consisted in a posterior proctotomy and excision of the growth, with the surrounding adipose tissue. About one-third of the sphincter was sacrificed. The opening was allowed to fill in by granulation.

The functional result of the operation was excellent. In spite of the loss of the sphincter action, the patient could control her movements for five minutes, and, when not suffering from diarrhoea, the linen was not soiled. She had no pain, and now, at the end of six months, there were no signs of a recurrence. She had gained fifteen pounds, and was able to do her work as well as ever.

## CARCINOMA OF THE RECTUM

DR JOHN A HARTWELL presented a man, sixty years old (Case No 7 of the series in his paper), who was admitted to Bellevue Hospital on July 4, 1904, with the following history. He had always enjoyed average good health, and gave no history of any chronic rectal trouble until about six months prior to admission. At that time he began to experience a rather severe knife-like pain at defecation, which often persisted for some hours. Shortly after this he noticed blood in the stools, and then put himself under treatment. The condition was diagnosed as hæmorrhoids, and he was sent to the hospital for an operation.

Examination at that time showed a markedly cachectic man, of small build, looking rather younger than his stated age. All his organs, excepting the rectum, were apparently normal. Rectal examination disclosed a rather friable mass nearly occluding the gut at a distance of an inch and a half from the anus. The inguinal glands were enlarged. A section from the growth proved by microscopical examination to be adenocarcinoma. A gland was removed for examination, and was declared to be non-malignant.

On July 9, 1904, inguinal colostomy was performed. A two-and-a-half-inch incision was made through the skin and external oblique, parallel to the fibres of the latter, at the level of the iliac spine, and just without the border of the left rectus. The internal muscles were opened in the direction of their fibres, and a knuckle of the sigmoid drawn up through the peritoneum, which was divided at right angles to the muscular incision. A point estimated as twelve inches from the anus was selected, and the gut here divided between two tape ligatures, protecting the wound by proper pads. The distal end was then fastened by the usual method in the lower angle of the wound. Next, a longitudinal incision was made in the linea alba at a level a little

above the first skin wound, dividing the skin and the anterior sheath of the rectus, which was here firm and resistant. The sheath was then raised from its muscle outward to the first incision, and the proximal gut end, protected by gauze, drawn between the two structures to the median wound, taking care not to damage the mesentery in this manipulation, but splitting it sufficiently to permit it to come through without tension. The open mouth of the gut was then fastened in the median skin and fascia wound, and the angle where it passed out of the peritoneum sutured to the membrane and the internal oblique muscle. The wound in the latter was then closed enough to gently constrict the angle and the distal end below, and the external oblique and the skin were then closed, excepting where the distal end emerged. A catheter was passed into the proximal end beyond its bend to allow the exit of gas. The wound was then carefully protected from later infection by gauze and collodion. The procedure required forty minutes, and was without shock.

The point, twelve inches from the anus, selected as the place for division of the gut allowed a sufficient length to the distal segment to cause no interference with the radical operation, and left a considerable pouch of the proximal sigmoid and colon to act as a fæcal reservoir. The wounds healed almost without suppuration. During the following four weeks the lower segment was irrigated through and through in order to cleanse it as far as possible.

August 9, 1904. The patient was placed in an exaggerated knee-chest position, and suspended from the lithotomy supports by a belly-band. An incision was made from the third sacral vertebra down to the scrotal angle in the perineum, encircling the anus, and, after clearing off the bones, the coccyx and two and a half sacral vertebræ were removed. The anus was closed, and the dissection upward from the point of the rectum was begun. A sound in the urethra facilitated its separation from the urethra and prostate. The peritoneum was opened when reached, and the rectum drawn down with its surrounding areolar tissue and freed on all sides for a distance of eight inches up, the vessels being clamped and tied as they were reached. The gut was then divided between two tape ligatures with the actual cautery, and the upper end closed with catgut sutures. The peritoneum was then sutured around the stump, and the stump fast-

ened in the depth of the wound after placing the patient in the prone position. This forced all these structures back, so as to make them easily accessible. The greater part of the wound was closed with tier sutures, and a gauze drain packed over the remaining raw surfaces and brought out through the perineal end of the wound.

The knee-chest position gave a perfect exposure of the parts, and lessened the bleeding to a remarkable extent, so that the dissection was almost an anatomical one. The change to the prone position facilitated the final steps markedly. A small hole torn in the gut at the site of the growth was immediately sutured, and no contamination resulted.

The fastening of the blind stump infraperitoneally guarded against peritonitis in case of leakage. The second operation occupied one hour. The patient was placed in bed in the dorsal position to facilitate drainage. Primary union was obtained in the whole line of sutures, and the drained cavity practically closed in four weeks. The patient was out of bed in seventeen days, and discharged on August 30, twenty-five days after operation. By that time he began to have considerable control over the inguinal anus. This control had steadily increased, and now, eight and a half months after operation, he was in excellent condition, knew when the bowels should move, and was able to keep back the movement for some time. There was usually only one movement a day, and he expressed himself as satisfied with his condition. There was no evidence of a recurrence.

DR JOHN A. HARTWELL presented also a woman (No 46 of the series in his paper), twenty-six years old, who was admitted to the Lincoln Hospital on March 18, 1904. Her family history was negative. During a pregnancy in 1900 she developed hæmorrhoids, which bled from time to time, the bleeding gradually becoming more severe. They were further aggravated by a second pregnancy in 1902, and from that time on she suffered almost continuously from bleeding and pain in the rectum. She continued to lose weight and strength, and at the time of her third delivery, in February, 1904, she was so emaciated that she lacked the strength necessary to reinforce the pains, and after being five days in labor she was delivered with forceps in a hospital. This resulted in a complete tear of the perineum and vagina through into the rectum for a distance of two and a half inches.



When she was admitted to the Lincoln Hospital she was markedly anæmic and emaciated, and so weak as to be unable to sit up in bed. The rupture of the perineum into the rectum during her recent pregnancy had left a large granulating wound. Incontinence was complete, and the vagina was filled with fæces and pus. The bladder was infected, the urine showing a heavy precipitate of pus. All the parts were exquisitely tender and her suffering was intense.

About a month was consumed in an attempt to get the parts clean preparatory to repairing the perineum. This failed, however, owing to the constant fouling with fæces and her poor resistance to infection. During this time she began to show symptoms of intestinal obstruction, despite the constant diarrhoeal discharge through the perineum. An examination under ether showed a constricting mass in the rectum, about two inches from the anal aperture, through which the tear into the vagina passed. A colostomy was at once performed by the method of spur formation, a glass rod passing through the mesentery underneath a knuckle of gut, which was opened on the following day.

Following this, the rectal and vaginal condition, as well as her general health, rapidly improved, so that on May 1 she was considered well enough for the radical removal of the rectal growth, which a pathological examination had shown to be carcinomatous.

Operation, May 1, 1904. With the patient in the exaggerated knee-chest position, an incision was made from the third sacral vertebra forward, encircling the torn anus and perineum well up to the vaginal sides. The coccyx and two and one-half sacral segments were removed. The rectum was then freed at the anal margin, and its dissection upward was completed for about six inches. The entire posterior vaginal wall, up to the cervix uteri, was included in the freed mass. The rectum was then amputated, the stump dragged down, and the peritoneum sutured around it, and this end was then fastened deep in the wound to prevent its retraction into the peritoneal cavity. The cloacal opening was partly closed with sutures and partly packed. The bleeding was exceedingly scant, owing, it was believed, to the knee-chest position. This latter was easily secured by suspending the patient, abdomen down, from the usual lithotomy supports,

her knees resting on a large sand bag and the thighs being bound to the supports

There was comparatively little shock, considering the extent of the operation, and the poor condition of the patient at the time. Convalescence was tedious, the wound being badly infected, and her general condition being one of chronic sepsis. The wound, however, gradually closed, the vagina and sacral cavity being continuous. She gradually gained in weight and strength, and left the hospital June 26, 1904, three months after admission.

At the present time, eleven months after operation, the patient is engaged as a house-worker and is enjoying good health. The colostomy wound, which had prolapsed to a moderate degree, gave sufficient control to keep her clean, and in no way interfered with her work. The posterior wound was still open at the sacral end, and the cervix uteri pouched through at this point. There was, however, no discharge to speak of, and the condition was not more than an annoyance. The cystitis had responded to treatment and was cured. Since the patient's discharge from the hospital, she had increased in weight from 85 to 125 pounds.

Dr Hartwell showed one other case (No 45, the latter a patient of Dr Adrian Lambert) in addition to the above, illustrating the method of radical treatment of cancer of the rectum, with particular reference to the inguinal colostomy as performed by him and described in the paper. He also showed a case of syphilitic stricture of the rectum on which an artificial anus had been done by the method described in the paper of the evening. These cases illustrated well the possibility of obtaining a very satisfactory control over the bowels through such an anus, as all of them were attending to their former duties, with no inconvenience from the deformity.

#### THE RADICAL TREATMENT OF CANCER OF THE RECTUM, WITH PARTICULAR REFERENCE TO THE INGUINAL COLOSTOMY

DR JOHN A HARTWELL read a paper with the above title, for which see *ANNALS OF SURGERY* for September.

DR TILTON said he did not think Dr Hartwell had given

quite enough credit to the treatment of these cases by excision and establishment of a sacral anus. He had observed several cases in which that procedure had been followed by extremely good functional results. He recalled one case, that of a woman, who was kept under observation for a year after the operation. She had absolutely no trouble with the movements of the bowels, and was apparently much better off than she would have been with a colostomy wound. The moral effect was less disagreeable. While Dr. Hartwell's method of operating in these cases may be less dangerous than other methods, as far as the immediate mortality was concerned, it had not yet been demonstrated by experience that there was less risk of a recurrence.

DR. JOHN B. WALKER said that in those cases of cancer of the rectum in which the growth was located within two or three inches from the anus the establishment of a sacral outlet for the feces would prove satisfactory. However, in the larger number of cases the growth is situated from four to seven inches from the anus, and in these cases the entire lower segment of the bowel should be removed. This will necessitate an inguinal anus, which should be made early before any symptoms of obstruction arise. Patients who are personally clean and careful learn to control the movements of the bowels and keep the skin adjacent to the anus quite free from irritation.

DR. GEORGE WOOLSEY said he had always favored a preliminary colostomy in these cases, partly on the ground suggested by Dr. Hartwell, namely, the exclusion of sepsis. Another reason for favoring this preliminary operation was that the hand could be introduced through the inguinal wound to determine the extent of the new growth and of the lymphatic involvement which would help to settle the question as between a radical and a palliative operation. In a case that he had operated on by this method three and a half years ago, the patient was still alive and in good condition. The speaker said he did not agree with the statement made that in so large a proportion of these cases the anal segment had to be sacrificed, and he recalled two cases in which he was able to retain it. In those cases where this segment of the gut had to be sacrificed, he thought the establishment of an inguinal colostomy was preferable to a sacral anus. The former was more accessible, could be more easily cleansed and kept continent.

DR HARTWELL, in closing, said that a complete colostomy had only been done in four or five of the forty-six cases he had recorded, while a lateral colostomy, for the purpose of relieving obstruction, had been done ten or eleven times. The speaker said he did not claim that the method of treating these cases by establishing a sacral anus did not in a few cases give good control over the fæces, but that it was not sufficiently radical, as by that method 50 to 65 per cent of surviving cases recurred, not more than from 15 to 25 per cent being cured. The formation of an inguinal colostomy wound and the removal of the entire lower segment of the bowel were the most radical methods of treating these cases. It did away with the irritation caused by the passage of fæces through the lower gut, which was a more important factor than saving the sacral segment.

#### ENDOTHELIOMA OF THE CAUDA EQUINA, EXCISION

DR CHARLES N DOWD presented a specimen obtained from a young man of eighteen years who was injured about seven years ago while coasting, a boy jumping on his back. Four years later he was brought to St Mary's Hospital complaining of pain at the lower end of the spine which had been persistent for more than a year, and, as the coccyx was broken and lay forward at a right angle with the sacrum, and was tender, it was removed. At that time there were no distinct sensory disturbances, but the Kernig symptom was present, and he had marked rigidity of the back, with lumbar lordosis.

In January, 1904, his back was still very rigid, there were lumbar lordosis and compensating dorsal kyphosis. He could not bend his back so as to touch the floor, but bent the knees for that purpose, and held the back rigid. The patellar, cremasteric, diaphragmatic, and ocular reflexes were normal. There was no clonus. Sensation was normal. There was tenderness on pressure over the lower lumbar spine. He suffered from so much pain at night that he was rapidly acquiring the morphine habit.

In June, 1904, his symptoms had increased, and his pain was uncontrollable from two to five or six o'clock every morning. This pain was definitely located down the back of the thighs and calves, and on the left side, back of the inner malleolus, to the plantar surface of the foot. On the right side it did not go below

the calf This distribution corresponded exactly to the diagram in Dr M Allen Starr's recent book for a lesion at the first sacral vertebra There was considerable atrophy of the thighs, particularly of the left, with fibrillary movements in the gluteal region There was much tenderness over the upper sacral region, and a marked gluteal reflex on pressure at that point There seemed to be slightly diminished sensation along the painful area, but this could not be definitely made out

An operation was advised by Dr Pearce Bailey, and was performed by Dr Dowd at the General Memorial Hospital on June 4, 1904 The opening was made at the site of the first sacral vertebra, a portion of the lamina of the last dorsal being removed A tumor was found within the dura, it had irregular white spots on its cortex, and in appearance closely resembled a tubercular lymph-node Fearing that this was a glioma, and that the fibres of the cauda were so incorporated in it that paralysis of the sphincters would follow its removal, he cut away a portion of the tumor for examination, and, feeling that pressure-relief would result from the opening in the spinal canal, he awaited the pathological report before further operation The patient recovered promptly His symptoms were very much relieved, and he passed several fairly comfortable months The pathological report was given with reserve, fibroma being the most probable diagnosis

In February, 1905, the patient again began to complain of his night pains, and on March 1 Dr Dowd removed the tumor of the spine The laminae and spinous processes of the fifth lumbar vertebra, most of those of the fourth, and part of the spinous process of the third were removed The posterior portion of the canal, corresponding to the first and part of the second sacral, was also removed The tumor was about two inches long and one inch in diameter, and was adherent to the dura There were a few spots of glistening white color below, but its general appearance had changed considerably since the first operation There was a slight leakage of cerebrospinal fluid for the first few days, and the patient had to be catheterized until the fifth day, when he voided his urine normally His pain had ceased, but he had a slight burning sensation in the right leg The pathological examination showed that the tumor was an endothelioma, probably arising from the lymph spaces of the pia mater

The symptoms which this tumor gave rise to were very definite, and corresponded to the classical description of a slowly increasing pressure in the region of the last lumbar and first dorsal vertebræ. In many respects, however, the case was an unusual one. Schlesinger tabulated 400 tumors of the spinal cord, 302 of which were intradural. In the entire list there were only six cases of endothelioma, sarcomata were much the most common type—118 in all. In a list of 264 tumors of the spinal cord, he found that 35 ( $13\frac{2}{10}$  per cent) were sacral, or of the cauda equina. Of course, the prognosis in these tumors was far better than in those that were situated higher up in the spinal canal. In the case shown by Dr Dowd, the prognosis depended entirely on the character of the growth, since the patient was now free from pain, had possession of all his faculties, and expected to begin work soon. So few of these tumors had been reported, that pathologists were much at variance in giving their diagnosis and prognosis. The relationship between trauma and the development of these tumors was interesting. Starr and Schlesinger both indicated a belief that traumatism might be an important element. The history of trauma in this case was very definite indeed.

DR WOOLSEY said that within the past two years he had seen two cases of endothelial tumor of the spinal cord, one intra- and the other extra-dural. In neither case was there recurrence so far.

# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting, April 3, 1905*

The President, HENRY R. WHARTON, M D, in the Chair

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### SCREW FIXATION IN CASES OF INTRACAPSULAR FRACTURE OF FEMUR.

DR GWILYM G DAVIS presented a man, forty-seven years of age, who, one year before, had fallen a distance of eight feet, striking on his right hip. The femur on the injured side had been fractured once before, when he was fourteen years old.

On examination, the right lower extremity was found to be shortened about 2.5 centimetres (1 inch). Pain on movement of the hip was very severe. The foot was everted, the fascia lata lax, and the greater trochanter moved with rotation of the leg. It was found to lie above Nélaton's line, and the base of Bryant's triangle on the injured side was shorter than that of the sound side. In short, there were present all the classical signs of a fracture of the neck of the femur. A skiagraph showed a line of fracture beginning above high up on the neck near the articular cartilage and running down almost vertically. The outer fragment was pushed up and was above the inner fragment.

On the sixth day after the injury an incision about 7.5 centimetres (3 inches) long was made over the greater trochanter, and an ordinary steel wood screw 7.5 centimetres (3 inches) long inserted up through the trochanter and neck into the detached head, traction in the meantime being made by an assistant. A plaster-of-Paris dressing was then applied, embracing the pelvis and down to the knee, and later the leg was placed on a sliding foot-piece to keep the foot from everting. The wound healed.

without trouble, but a sinus formed later at the site of the screw, and it was removed after having been in eight weeks. Two or three weeks later the patient was discharged, and now, a year after, he has apparently bony, or at least firm, union, very little shortening, almost normal movements, a slight loss of abduction, and walks comfortably without any support, and only a slight limp due to the uncorrected small amount of shortening.

Dr Davis further remarked that the results obtained by the various methods of treatment of fractures of the neck of the femur in those other than children and the aged are as yet so unknown that it is impossible to say which is best. That the methods usually pursued and the results obtained by the mass of the profession are unsatisfactory is evident from the frequency with which ununited fractures of this part are seen. In children, conservative treatment by splints and apparatus has been demonstrated to be efficient. In the aged, say, those over sixty years, bad results are accepted with a certain amount of resignation, but when an otherwise healthy man, from twenty to fifty odd years of age, is left with an ununited fracture of the neck of the femur, the distress and disability are so marked as to justify radical measures in order to avoid it. Many of these patients have more or less pain, a marked hobbling gait, and are often compelled to use a support, such as a cane or crutch. They are debarred from all active occupations, and perhaps relegated to the ranks of useless cripples. The most usual way of treating the injury is probably by weight extension, the same as if the fracture was lower down. The uselessness of this method is seen from the resulting ununited fractures. Of the value of other methods we have as yet too little data to judge. The treatment of this fracture in the aged by the method of combined weight extension and lateral traction has in his hands been far more satisfactory than by weight extension alone. The method of placing the limb in an abducted position in plaster-of-Paris is likewise better than using weight extension alone. He had recently had one good result from this method, but, to offset this, he recently saw a case in which the method had been equally faithfully applied without union occurring.

Having previously operated on several cases of ununited fracture, he decided to apply a modified form of the same method to recent fractures of the neck of the femur, and the good result



obtained in the case shown had encouraged him to resort to the same plan in future cases

DR W W KEEN briefly detailed a case in which he had employed a device similar to that of Dr Davis. The lesion differed, however, in being an old, ununited fracture which required an anterior incision to freshen the bone in addition to the lateral one for inserting the screw. The patient can now walk without the aid of crutches or a cane. Two screws were employed to unite the fragments in this instance, and they are still *in situ* after more than a year. The case will be reported in full later.

DR ROBERT G LE CONTE said that the proposition advanced by Dr Davis, of immediate operation in intercapsular fracture of the thigh, was a very broad one. In these days of modern asepsis the ideal treatment of fracture of the femur is perhaps the open method, whether the break is intercapsular or of the upper portion of the shaft, and yet no one is quite bold enough to carry out this method in every case. In Dr Le Conte's experience in patients whose ages range from forty years to extreme old age, the non-operative methods of treatment in intracapsular fractures result in giving useful and valuable legs in perhaps 80 per cent of the cases, in about 20 per cent this favorable result is not obtained. These statistics are not exact and are given from memory only. Granting that good results are obtained without operation in four out of five cases, why should we not continue the expectant method of treatment as opposed to the operative. If union fails to occur, operation can be later performed with little, if any, radical risk. It should be remembered that some of the cases of useless limbs following the expectant or non-operative treatment are due to osteophytes forming about the seat of the fracture and mechanically interfering with the motion of the joint, and not to ununited fractures. Dr Le Conte would be very loath to indorse the statement of Dr Davis that the majority of recent intercapsular fractures of the femur should be treated by the open method.

DR JOHN B ROBERTS did not believe the ideal method of treating fractures of the femur is by incision, in certain cases only is it advisable. In fact, the ideal method is treatment without incision, especially in fractures of the shaft. Unless the break is in the upper third, we expect good results from treatment by traction, elevation of the bed to secure counter-traction,

and lateral support. He approaches such cases with utmost confidence that good results will follow this treatment, and in but few cases is there disappointment. Contrary to Dr Le Conte, he would not call this expectant treatment. In the case of fracture of the neck of the femur we are not always sure that it is intracapsular, in the case exhibited, the skiagraph seems to indicate that it is partly outside the capsule, which is often the true condition present. In Dr Roberts's experience, in a man of the age of Dr Davis's patient with a fracture not entirely intracapsular, good results may be expected from treatment by weights, counter-traction, and lateral support. This he would not call the expectant, but the non-operative method of treatment. It is interesting to hear Dr Davis speak of the sinus following the use of the screw, as that has been Dr Roberts's experience with the use of nails. Suppuration nearly always occurs, and there is delay in closure of the sinus after the nail is withdrawn. Dr Roberts has been surprised to find good results without operation in a few patients seventy or eighty years of age, with what were at least supposed to be intracapsular fractures. When the fracture lines are apparently through the base of the neck outside of the capsule, a good leg should be expected without operation.

DR DAVIS, in closing, said that an interesting point in these cases is the correctness of the diagnosis, it is often difficult to demonstrate whether the break is intra- or extracapsular. Anteriorly, the capsule extends downward to the anterior intertrochanteric line, and nearly every fracture is bound to be intracapsular at this point. Posteriorly, the capsule extends half-way to the intertrochanteric line, and in some instances even more. Hence many fractures are partly intra- and partly extracapsular. It is not possible to make a differential diagnosis with any degree of certainty. He supposes that Dr Le Conte's statements refer to fractures of the neck alone, as it is well known that extracapsular fractures involving the trochanters unite readily and with an abundance of callus. As to fractures of the neck they are not so satisfactory. If Dr Le Conte's figures embrace all the fractures of the aged, 80 per cent of good results is a trifle high, he is not willing to admit this. Dr Roberts' statements regarding the good results in fractures partly intra- and partly extracapsular are not capable of verification as such diagnosis cannot be made the absolute condition is unknown. As to the results of intra-

capsular fractures, it was held years ago that they almost never unite by bony union. When they are partly intracapsular and partly extracapsular, good results might be expected in young adults. Notwithstanding this, the experience of Dr. Davis is that results in general are bad in fractures of the neck of the femur in young and middle-aged adults, this opinion is based on eight or ten cases seen during the past four years, all in individuals between twenty-five and fifty years of age. Ununited fractures during this period are not uncommon. Dr. Davis does not advise operative treatment in children nor in the aged. In the latter class, reparative efforts are slight, in children, conservative methods give good results. In certain other cases, as in the patient exhibited, disability from failure of conservative treatment is so great, and the occurrence of this result so frequent, that a more positive method of treatment is desirable. Dr. Davis does not, however, positively advise open operation in all cases, but would not hesitate to employ it in comparatively young adults, under sixty, otherwise healthy, who have intracapsular fracture. For treating these fractures there are now recognized two methods that are still largely untried. They are, 1, placing the thigh in abduction, and, 2, applying longitudinal traction and lateral traction combined. The use of these methods has as yet not been so extensively reported as to determine their true value. As a competitor of the two, to be tried out with them, Dr. Davis adds a third, the open incision and insertion of a screw as detailed in the reported case. The operation is simple, being little more than a straight incision with insertion of the screw while extension is made. Healing always readily occurs. When the screw loosens, an inflammatory focus forms beneath the scar and this tissue soon gives way, producing a sinus through which the screw may be removed. Operation does not appreciably add to the danger of the treatment and gives improved results.

#### ANTHRAX

DRS. G. J. SCHWARTZ and B. FRANKLIN ROYER presented, jointly, a man, aged twenty-four years, white, single, occupation, farmer, who was admitted to the Jefferson College Hospital, in the service of Dr. W. W. Keen, February 21, 1905, suffering from anthrax, and with the following history.

The farm on which he labored was situated at the head of a small stream, along the borders of which a number of cases of bovine anthrax occurred in 1899. Some of them were in the immediate vicinity of the farm. Since then this meadow land has been "out of the tide," so that it has been impossible to pasture cattle or cut hay. The farm being at the head of this stream has made the meadows drier and admitted of some pasturage, and last season considerable rough hay was cut upon it. Unknown to the health authorities, two apparently healthy mules belonging to the patient's father became suddenly sick, and died within two days of each other. The supposition was then that they were poisoned. Their carcasses were buried in this field. Later in the season, a crop of hay was harvested from the field. This hay comprised a portion of the fodder of the stock farm.

On February 12, 1905, two apparently healthy cows, which had been eating the hay harvested from the above mentioned field, were turned out in the morning and died during the day. The patient skinned the last cow which died and sold the hide to a dealer, who expressed it to this city. The patient noticed while skinning the cow that a bloody serum exuded from several sores on the hind quarters of the cow.

On February 14, 1905, two days later, the patient noticed a small red spot, which resembled a flea-bite, situated about one inch above the left wrist-joint on the posterior external surface on a line passing through the first metacarpal bone. The next day two papules appeared on flexor surface of the same wrist. These papules gradually became larger and were accompanied by slight itching and burning. During the next day a small blister containing a yellow serum streaked with blood and surrounded by an inflammatory band, œdematous, with overlying skin of livid hue, appeared.

On February 18, six days after skinning the cow and four days after the lesion appeared, the patient complained of slight headache and cough, by this time œdema had involved the hand wrist, and was rapidly extending up the forearm, blisters had become blebs, were tense, and contained a distinctly blood-tinged, yellowish serum.

The following day, February 19, he became alarmed about his condition and went to bed. The headache became very severe. Cough became productive pain in arm throbbing, swelling ex-

tended rapidly to the arm. Now, for the first time, the patient sent for his family physician. Local applications were made. During the night the patient was restless, could not sleep, and felt much weaker.

On February 20, condition was much worse, and his physician decided to send him to the Jefferson Hospital, where he arrived February 21.

His condition on arrival was as follows. Facial expression was that of a person suffering considerable pain and mental anxiety, face was flushed, and there was slight sweating about the forehead, pupils dilated, tongue slightly coated and dry, slight nausea with no vomiting, temperature,  $100.4^{\circ}$  F, pulse, 82, soft, compressible, respiration, 24. A brief physical examination of chest showed heart and lungs apparently normal with the exception of a few râles posteriorly on both sides. The left hand, forearm, and arm to within 10 centimetres of the shoulder-joint were immensely swollen. The swelling pitted on pressure, and there was an entire absence of emphysematous crackling. The overlying skin was of a slightly dusky red color, and pressure caused the redness to slowly disappear, but it returned slowly when pressure was removed. The axillary lymph glands were not palpably enlarged, but on palpation the spleen seemed to be enlarged. Situated along the forearm on the flexor surface were several medium-sized blisters containing a cloudy, yellowish serum, and just above the wrist-joint over the line of the artery was a large bleb the size of a half-dollar filled with blood-stained serum.

Smear preparations, cultures, and a blood examination for the anthrax bacillus made, and within one hour's time a verbal bacteriological report confirmed the clinical diagnosis.

The report, from a later more exhaustive examination, was that the bacilli obtained in spreads from the blebs of the left forearm possessed the morphological and tinctorial characters of the *Bacillus anthracis*. In cultures, a bacillus, possessing the morphology, tinctorial, and biological characters of the *Bacillus anthracis* in pure culture. The blood taken from the right arm developed no growth, indicating in all probability that the infection at the time of examination was local in nature.

The following treatment was carried out. The patient was etherized and five drachms of a 3 per cent solution of carbolic

acid was injected into the skin and superficial fascia, so it would completely encircle the arm one and one-half inches above the infiltrated tissues. The bullæ over wrist and back of forearm and a ring of healthy tissue around each of these were excised down to the deep fascia. The infection did not seem to go below the deep fascia except over the radial artery just above the wrist. This suspicious tissue was removed, and in doing so the radial artery was wounded. After tying both ends of the artery, several syringefuls of a 3 per cent solution of carbolic acid were deeply injected into the tissues around the areas removed. After this was completed, long multiple longitudinal incisions were made into the œdematous tissues, allowing a large quantity of clear yellow serum to exude.

The tissues, on incision, presented a yellowish color, gelatinous and very friable. At no point was any pus found. The limb was then wrapped in hot antiseptic fomentations, placed on a pillow, and surrounded by hot-water bags.

At the end of the operation the patient was severely shocked and intravenous infusion of salt solution was then given by Dr Anderson.

The patient received free stimulation-strychnia and atropine, and every three hours, while he remained in the hospital, received a hypodermic injection of 30 minims of 3 per cent carbolic acid.

The patient was transferred to the Municipal Hospital the following morning after the operation. His condition on removal was fair.

On February 23, 1905, was received a report from the State Board of Veterinary Medical Examiners, stating that the body of the cow skinned by the patient showed lesions of anthrax.

Dr Schwartz said that most authorities advise excision<sup>1</sup> of the malignant pustule and cauterization with pure carbolic acid.<sup>2</sup> Tillmans, of Leipsic, holds that anthrax remains local longer in man than in animals, hence, excision and cauterization should be employed in human anthrax. He excises the area of infection, going well into healthy tissues, and cauterizes it, then injects in and about it a 1 to 1000 solution of bichloride of mercury and a 5 per cent solution of carbolic acid. By this treatment,<sup>3</sup> Lenoyel and Koranyi lost but thirteen cases out of 142. Muller,<sup>4</sup> in opposition to the above treatment says that it is impossible to destroy the disease by excision of the seat of inoculation. In

guinea-pigs, amputation of a limb performed a few hours after inoculation fails to prevent the disease. His belief is that treatment should aim to make the cells about the inoculated area prevent dissemination of the bacteria and protect the body. The products are injurious, if absorbed, but they also tend to destroy the bacteria, hence excision is harmful.

Muller's treatment is as follows. Immobilize the parts, and elevate, if an extremity, apply mercurial ointment and give alcohol internally in large doses. He describes thirteen cases successfully treated by the above method. Notwithstanding the above, the majority of reports lean towards excision with cauterization of the infected area.

Cauterization with cautery, pure carbolic acid, caustic potash, hydrochloric acid, acid nitrate of mercury, and, in fact, every caustic substance known, has been either tried or suggested.

*Medical Treatment*—Muskett<sup>5</sup> notes the treatment of fifty cases by simple applications of ipecac to the area of infection without excision, and without a fatal result in any case.

Laboratory experiments have shown that powdered ipecac will destroy the anthrax bacillus, but has no effect on the spores, and in the body sporulation does not take place.

*Injection Method*—Scharnowski<sup>6</sup> reports the treatment of fifty cases by carbolic acid injections, with a mortality of 2 per cent.

Graef<sup>7</sup> reports the treatment of 384 cases by cauterization with caustic potash, with a mortality of 5 per cent.

The treatment by caustics is, however, very painful, and, after all, it seems impossible to say which treatment is best for all cases, for each individual case must necessarily be considered as standing absolutely alone.

DR B F ROYER stated that on admission of the man to the Municipal Hospital, smears made from scrapings from the floor of the extirpated areas, and smears of blood made from a finger prick, failed to show anthrax organisms. The blood count at this time showed Leucocytes, 19,400, erythrocytes, 3,210,000.

Hæmoglobin not estimated.

Differential count (600 cells count), polynuclear leucocytes, 87.68, large lymphocytes, 7.66, small lymphocytes, 2.66, eosinophiles, 2.00.

*Urine Analysis*—Chemical Examination. Amber, acid,

10 12, no sugar, albumen ? Microscopic Examination Leucocytes Numerous hyaline, epithelial, and granular casts Urine centrifuged, and the sediment examined for anthrax organisms with negative result

Smears and cultures made at this time from the nasal secretions from the saliva and from the fæces failed to show anthrax germs

Second day after admission, tenth day of the disease, physical condition improved, pleuritic pain less marked, pulse of better volume, temperature normal, urine loaded with hyaline and granular casts

Eleventh day of disease, third after operation, abdominal distress and frequent desire for stool suggests mercurial poisoning Salt solution substituted for the arm Blood culture made second day after admission negative

From this time on nothing of very great interest resulted Leucocyte count, sixth day after admission, fourteenth day of disease, is 20,400 Erythrocyte count, 3,400,000 Urine still filled with hyaline and epithelial casts Anæmia probably due to nephritis For the next few days the kidneys were somewhat erratic, 111 ounces being voided on the seventh day after operation and 128 ounces the ninth day after operation General condition seems to be good

Blood culture made nine days ago still showed no growth

From this time until the forty-fourth day of his disease nothing worthy of special consideration occurred He was detained at the Municipal Hospital thirty-five days, while the wounds from operation were healing On being discharged, he returned to Professor Keen's clinic, where he was shown to the students

Dr Royer remarked, further, that the most marked advance in the treatment of anthrax has been made in Italy In America, where the disease but infrequently occurs, we are apt to lose interest in the disease, or we may fail to keep in touch with the most recent advances in its treatment This disease has long been considered a surgical affection The day seems to have dawned, however, when a more scientific treatment is available This newer method of serum treatment was introduced by Professor A Sclavo, of the University of Siena, in 1897 The underlying principle with this therapy, and in fact with nearly all serum



therapy, is to get from a susceptible animal the substance manufactured by that animal in acquiring a tolerance to many times its fatal dose of toxin

Sclavo's <sup>s</sup> method of producing this serum is based on vaccination and upon immunization by toxin injection. He first vaccinates an ass with an attenuated anthrax culture, and in ten or twelve days with a more virulent culture. So far, then, the process is like vaccination in principle. The object is to protect against a dangerous disease by deliberately inoculating with a harmless disease. This is the method practised by veterinarians in immunizing herds. The next steps are to use virulent cultures of anthrax in increasing quantities until enormous doses can be tolerated. This is comparable to the process in making diphtheria antitoxin, but differs from it as follows. In inoculating horses, to make antidiphtheritic serum the toxin only is used. This germ can readily be separated from its toxin. Not so, however, with anthrax. Here we have an intracellular toxin. (At least it appears to be intracellular in artificial media.) For this reason it is necessary to inject the entire culture. The process and results, however, are very similar to that of making diphtheria antitoxin. After a period of several months of such treatment, the ass is bled, and the serum separated from clot is preserved by adding ether to the extent of 3 per cent of its bulk. The serum is now tested on rabbits by first inoculating a series for controls and an equal number for treatment with 5 cubic centimetres of a suspension of a culture of anthrax grown on agar for two days. The test rabbits are given at the same time 10 cubic centimetres of the prepared serum, usually by injection in an auricular vein. This testing, you see, is similar to the test for diphtheria antitoxin. If the controls all die and the treated ones are all protected, the serum is regarded as high grade. As yet, Sclavo seems to have no method of standardizing as we have in the production of diphtheria antitoxin.

Sclavo's <sup>s</sup> present contentions are as follows. (1) The serum is innocuous even in large doses, (2) it can be well borne, even when introduced into the veins, (3) no case taken in an early stage and of moderate severity will be fatal if treated with the serum, (4) by its means some cases may be saved when the condition is most critical (he narrates one case in which a woman recovered after bacilli were found both in the blood and urine,

and another in which they were present in the urine), (5) when injected into the veins it quickly arrests the extension of the oedematous process, so as to reduce notably the danger of suffocation which is present in many cases when the pustule is situated on the face or neck, (6) if used early enough, it reduces to a minimum destruction of the tissues when the pustule is localized, and thus diminishes risk of deformity, (7) persons attacked appear to become convalescent almost at once. The dose of serum recommended in ordinary cases is 30 to 40 cubic centimetres subdivided into three or four injections, subcutaneously into different parts of the abdomen, and followed in twenty-four hours, if there has been no improvement, by further injection of 20 to 30 cubic centimetres. In very grave cases he recommends intravenous injection, preferably into one of the superficial veins on the back of the hand, of 10 cubic centimetres, followed in an hour or two, where no improvement is shown, by another similar dose.

Bandi<sup>9</sup> reports two cures. In one cauterization had failed. There was oedema of the entire arm, the glands in the axilla were as large as a hen's egg. Fever,  $104^{\circ}$  F, pulse rapid and intermittent and patient in coma. Anthrax organisms were found in blebs surrounding the cauterized areas and in the blood by culture. In this case 150 cubic centimetres of a serum, prepared by using a sheep and Sclavo's methods, were given intravenously, and followed later on the same day by 50 cubic centimetres intravenously.

In his second case, with temperature  $103^{\circ}$  F, rapid, irregular pulse, swelling and oedema of the arm, and with a positive blood culture, cauterization, and 80 cubic centimetres intravenously and later 30 cubic centimetres subcutaneously, promptly cured the patient.

Recently, Lockwood<sup>10</sup> and Andrews treated a case of malignant pustule of the cheek with 40 cubic centimetres Sclavo's serum injected subcutaneously. No other treatment was given, the oedema increased, the enlarged glands subsided. Recovery most satisfactory.

Bowlby and Andrews<sup>11</sup> report a case of malignant pustule of the forehead treated with Sclavo's serum and recovery. In this case the glands at the angle of the jaw were much swollen. They rapidly subsided. The oedema extended for a time after treatment was begun. Recovery was satisfactory in every particular. No other treatment was given.

Legge<sup>12</sup> has studied a series of cases treated by Sclavo and others in Italy, and those treated in England since July, 1904. His study, reported in his Milroy Lecture, would encourage one to recommend anti-anthrax serum as almost a specific against this dreaded disease if given early. If given late, it may be necessary to practise excision or free drainage in addition to serum therapy.

From the data presented by Legge, Bandi, Soberheim, and Sclavo it would appear that the time had come when we in this country should have a supply of anti-anthrax serum kept by health boards or research laboratories where it might be gotten in a few hours by those called upon to treat anthrax.

When this case was sent to the Municipal Hospital, he communicated with Parke, Davis & Co., H. K. Mulford & Co., the Marine Hospital Laboratory, and through Dr. Cairns, of our health office, with the Bureau of Health of New York, but could find no serum in this country. This patient's treatment consisted of stimulation with whiskey, strychnine, and quinine, carefully looking after the emunctories and diet, and flushing him with large quantities of water. When evidence of mercurialism developed, the bichloride dressing was omitted. Salt solution was used for twenty-four hours, and then potassium permanganate, 1 to 5000, as a wet dressing. Later, a 1 to 8000 bichloride dressing was used until the arm was nearly healed. Where the indurated areas were dissected out, curettement was required, and, later, stimulation with silver nitrate brought granulations to the surface.\*

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DR W W KEEN said that when the resident physician notified him by telephone of the patient's admission, he at once suspected some animal disease, as anthrax or actinomycosis, and directed that a bacteriological diagnosis should be made at once. The subsequent history shows that we now possess a thorough means of prompt diagnosis, as within one hour the examination had been made and anthrax bacilli found. Dr Keen saw the man one and one-half hours after admission. A slight pimple had been present on the wrist, but no pustule. The most conspicuous features were a number of large blebs and an enormous œdema of the arm. At the deltoid insertion the arm was fully one and one-half times as large as immediately above that point. The case then was one of anthrax œdema. The communicability of the disease to others demands attention. This patient was isolated, and the operation performed in the same room rather than in the operating-room. Afterwards the bacilli were repeatedly recovered from the room, five separated disinfections being required to remove them, removal of the floor was at one time seriously contemplated. This shows the great importance of investigating rooms where fluids have fallen during operation, as otherwise subsequent patients might very easily obtain anthrax infection. Dr Keen has communicated with Dr Abbott, of the Philadelphia Bureau of Health, who has taken steps to secure from Professor Sclavo, of Italy, some of the serum which has been used with such good results. It is hoped that the serum may be kept on hand to use in future cases.

DR DE FOREST WILLARD believed that even when serum treatment is employed, the original point of infection in anthrax should be excised in order to get rid of all the infection possible. He detailed a very severe case that occurred in a wool-sorter. There was a pustule with blebs and an ulcer of the cheek, anthrax bacilli were present in great numbers. Immediate diagnosis was followed by immediate removal of the pustule and by cauterization. Though there was great local œdema, speedy amelioration of the local symptoms followed. The patient, however, apparently infected his food, and in two or three days there was enormous distention of the abdomen with tormina and tenesmus, twenty or thirty stools occurring daily. Suppuration followed, and three quarts of pus were removed from the abdomen and several ounces from the scrotum. For weeks the patient was

almost at the point of death, but he finally recovered Antistreptococcic serum was employed during a week or two, but incision appeared to do the most good The patient was isolated and none of the attendants became infected The room was thoroughly disinfected, and no other case developed

DR JOHN H JOPSON spoke of the frequency of anthrax in Philadelphia, he regards it as more common than most physicians suppose He saw and reported a case some years ago from the Episcopal Hospital dispensary, it being the first of a small series of cases occurring among the morocco workers in that neighborhood Mutchler, Miller, Willard, and Given have also reported cases, at least eight, occurring during the past ten years Three were treated in their own homes by hypodermic injections of carbolic acid and recovered

DR ROYER, in closing, said the precautions taken with the patient at the Municipal Hospital consisted in keeping him in a tent and disinfecting the discharges with 3 per cent solution of carbolic acid for one-half day The nasal secretions and sputum were collected on gauze and immediately burned The linen was soaked one-half day in 3 per cent carbolic acid, then steam sterilized, boiled, and washed The question of disinfecting the outfit when the patient left the hospital was solved by placing the tent, bedding, and other contents in the large steam sterilizing apparatus used in disinfecting clothing for the city and subjecting them to live steam, under five pounds pressure, for one hour on each of three days Three test objects containing anthrax bacilli were also exposed, one being removed at the end of each sterilization, the bacteria were all destroyed The bedding has since been used with no untoward result

#### FILLING DEFECTS IN THE SKULL BY BONE CHIPS FROM THE OUTER TABLE OF THE NEIGHBORING BONE

DR W W KEEN reported the case of a man, aged twenty-four years, first seen by him September 15, 1903

Three years previously he had received a violent blow from a golf-stick on the forehead just below the border of the hair and about 1 centimetre to the right of the median line The golf-stick was broken and a portion of it was left sticking in the wound He was knocked down by the blow and stunned With assistance, in a few minutes he got up and walked to the house

He was never unconscious, was never sick enough to be in bed. A local doctor who was called seized the bit of golf-stick, pulled it out, and sewed up the wound. Healing took place by first intention, and the wound never gave him the slightest trouble in the way of headache, pain, or other disturbance until about a month ago, when a small abscess formed at the site of the accident and discharged a little pus. The day after the accident he went with a party of young people on a "hay ride." Neither he nor his doctor or friends had the least idea that his skull had been fractured.

Examination revealed, just below the border of the hair, a scar about 3 centimetres long and at its middle a sinus, the result of the old abscess. A probe discovered some bare bone.

An incision was made in the line of the old scar, which disclosed an unsuspected triangular bit of wood 1.5 centimetres long, 8 millimetres broad, and 4 millimetres in thickness. As soon as this was removed, it was apparent that it had filled up a depression which was 1 centimetre deep. At the time he received the blow, the skull had been fractured with depression of the fragment, and implantation of two pieces of the golf-stick in the wound. One piece had been removed, and this second piece of wood, together with the tissues about it, filled up the depression, so that no irregularity existed on the surface.

Inasmuch as Dr. Keen had seen two cases of fibroma and sarcoma result from such a depression of the skull, and epilepsy in many other instances, he deemed it essential that the depressed portion of bone should be removed. Accordingly, he carefully chiselled the depressed portion through until he reached the dura, and then by means of the rongeur forceps removed all of the depressed bone. The depressed portion exercised considerable pressure on the dura. In removing it he had to uncover the superior longitudinal sinus. The opening that he made was 3 by 2 centimetres.

The patient made a prompt recovery without any rise of temperature whatever.

A second operation to fill in the aperture in the skull was done February 23, 1904. He first made a flap, including the old scar and the scalp on each side of it, by a semicircular incision with its convexity posterior, the ends of which barely reached the border of the hair; the rest of it being therefore covered by the

hair From this first incision he made a second directly backward Dissecting these flaps away, he was able finally to lay bare the dura and the healed margins of the opening By the rongeur forceps he made the margin raw all around the opening He then chiselled a number of pieces from the outer table of the skull under the flap that he had turned back and filled in the opening in the skull entirely The flaps were then replaced and sewed together, a small bit of folded rubber dam serving as a drain for twenty-four hours

The man made a perfectly smooth recovery without any rise of temperature On the ninth day he went home The ugly depression on his forehead which had existed prior to this operation had entirely disappeared, and, with the exception of one point where there was a very slight prominence of one of the bone chips, his forehead was entirely normal

In the autumn of 1904, six or seven months after the last operation, he was seen, and it was found that the inequality in the surface of the skull had entirely disappeared

Dr Keen remarked that this case was worth reporting on account of the entirely unsuspected nature of the injury, for no one examining his skull would have supposed that there was a depressed fracture In addition to this, the mode of filling up the aperture is one which he first proposed probably eight or ten years ago He had now practised it in fully a score of cases This is the smallest opening he had filled by these bone chips chiselled from the neighboring outer table In other cases he had filled in areas 6 to 7 centimetres by 3 to 5 centimetres, in other words, large openings The skull becomes in time very solid and strong, reproducing practically a normal skull so far as both outline and protection are concerned The margins of the opening, of course, should always be made raw by the rongeur forceps, and the pieces of bone which fill in the opening should not be too large He had found the best instruments for procuring them are a gouge and mallet Never in a single instance had he had any of the pieces of bone undergo necrosis, and so to require removal

#### EXCISION OF THE TIBIA

DR FRANCIS T STEWART said that he was indebted to Dr Le Conte for the privilege of operating upon and reporting the following case

The patient is a Polish boy, aged ten years, from whom it was difficult to obtain any definite history. About seven months ago the right knee and leg suddenly swelled and became excessively painful. The patient was confined to bed for several weeks with marked constitutional symptoms, and has not been able to use the leg since. There is no history of injury. At the time of operation, the entire tibia and the lower end of the femur were markedly thickened, and the knee was ankylosed at an angle of about 40 degrees. Along the course of the tibia were numerous sinuses leading down to necrotic bone. Under ether a feeble attempt to straighten the knee resulted in a fracture of the femur just above the condyles, thus allowing the limb to be fully extended. An incision was made down to the tibia from the knee to the ankle and the entire diaphysis excised subperiosteally, leaving the lower epiphysis and a shell of the upper. In curetting the upper epiphysis the instrument at one point entered the knee-joint, which was found to be filled with hard, fibrous tissue. The entire wound was packed with sterile gauze and the limb placed in a fracture-box. Bacteriological examination of the specimen showed the infection to be that of the *Staphylococcus pyogenes aureus*.

Dr. Stewart said that he had had two other similar cases, one concerning the tibia and the other the fibula. The tibial case was a boy of twelve years who developed an acute osteomyelitis following a trivial injury. The limb was treated for four weeks with poultices, at the end of which time he saw him and excised the bone subperiosteally, saving the upper and lower epiphyses. At the end of six months the tibia had regenerated and was much thicker than normal. There was a little flexion of the knee and a slight varus of the leg, but withal a useful limb. In the fibular case, a boy of nineteen years, a contusion of the outer side of the leg was followed within a few days by marked constitutional disturbance, which was diagnosticated typhoid fever. Four months later he saw the patient, and removed the bone subperiosteally, excepting a small portion of the upper and lower ends. The infection in this case proved to be the *Staphylococcus pyogenes aureus*. The bone regenerated promptly, and the patient returned to his work as a laborer at the end of six months.

At the 1904 meeting of the American Surgical Association, Dr. Johnson read a paper on this subject, and among other points



emphasized the following Regeneration in all his cases, six in number, was rapid and complete Deformity never results where a disc of bone is left between the shaft and the epiphysis The companion bone invariably takes on compensatory hypertrophy During the operation the periosteum should be spared as much as possible, and the curette should be used very cautiously The leg should be immobilized in a fracture-box and frequent and rough dressings avoided The part should be moulded with bandages or adhesive strips as bone tissue develops, and the young bone should be protected by means of plaster of Paris

Nichols (*Journal of American Medical Association*, February 13, 1904) states that the reason the regenerated bone is at first much larger than the original shaft is that the bone is not completely ossified In time the size decreases almost to normal, and, judging from skiagrams, a new medullary canal develops He thinks the best time for operation is about two months after complete drainage of the acute infection

In regions, such as the thigh or the arm, where there is no companion bone to act as a splint and maintain the length of the part, one should wait until the periosteal shell of regenerating bone is sufficiently advanced to preserve the contour and bear the weight of the limb Roughly, this stage is reached when the periosteal shell, as determined by the X-ray, is equal to one-fourth of the diameter of the original shaft

DR ROBERT G LE CONTE said that he had operated upon six cases of osteomyelitis where the whole shaft of the tibia was involved in the disease These cases varied from the very acute to the very chronic stages of necrosis, the duration of the disease being from five days to seven or eight months He believes that the deposition of bone from the unremoved periosteum depends upon the length of time the disease has lasted In the chronic cases, months after the onset of the acute symptoms, the regeneration of bone is reduced to a minimum, while in the acute stages, say two or three weeks after the onset of the disease, the periosteum is in an active state for bone regeneration In the personal cases mentioned, more or less good bone was formed in four of the patients with useful limbs, partial deposit occurred in one, and in the other no bone whatever was formed

DR DE FOREST WILLARD said his experience had not been so favorable, since regeneration of bone is slow and imperfect in old

cases Osteomyelitis should be treated as is appendicitis, by early diagnosis and early operation within forty-eight hours if possible, not waiting until the case has been treated for months for other diseases, as rheumatism, typhoid fever, etc

DR JOHN H GIBBON referred to the report of a case by Dr Huntington, of San Francisco (ANNALS OF SURGERY, February, 1905), in which the entire shaft of the tibia had been removed and the shaft of the fibula substituted After the removal of the tibia the result was not completely satisfactory, and the author divided the fibula near one of its extremities and attached it to the corresponding epiphysis of the tibia A few months later the other end of the fibula was also divided and attached to the other epiphysis of the tibia The result of this transference was most satisfactory

DR STEWART, in closing, said that several cases of bone grafting had been reported The bone is obtained from the same individual or from animals Morton used in one case bone from a dog, and Senn has employed a similar expedient, using bone from the same individual

# TRANSACTIONS

OF THE

## CHICAGO SURGICAL SOCIETY.

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*Stated Meeting, March 6, 1905*

The President, DR L L McARTHUR, in the Chair

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### DERMOID CYST OF LUNG

DR NICHOLAS SENN presented a man, aged twenty-three years, American, unmarried, a railroad man by occupation, who entered the Outpatient Department of the Michigan University Hospital in July, 1904. The case was carefully studied there, and a history of it accurately reported by the attendants at the clinic, and particularly by Dr Roger S Morris, by whom a complete history of the case was published in the *Physician and Surgeon* of January, 1905. The history of the case as related by Dr Morris is as follows:

"The patient was admitted to the medical ward of the University Hospital on July 27, 1904, and the following history was obtained:

"On admission the patient complained of cough, expectoration of large quantities of foul-smelling sputum, and hæmorrhages from the lungs.

"About nine years ago (eight years, according to out-patient history), that is, about the time of puberty, the patient had a severe attack of pneumonia on the left side, followed by a feeling of tightness across the chest and pain on breathing, the latter was localized to an area about the size of a hand in the precordial region. Prior to the attack of pneumonia the patient says he was struck over the heart by a drunken man, and ascribes

the pneumonia which soon followed to the blow which he received. Between the time when he was struck and the development of the pneumonia, he had severe neuralgic pains in the region of the heart and in the left shoulder. A year later the patient had another attack of pneumonia, which lasted about eight weeks. During a coughing fit a large quantity of 'pus' was coughed up at one time ('over one quart'). The 'abscess' or 'empyema' discharged three times in the next three or four days. The patient describes the so-called pus as a 'yellow, semi-fluid material'. After raising this material, the patient became much better, but has coughed and expectorated a good deal ever since. Four years ago the patient had a very severe hæmorrhage from the lungs, and since then he has had one about every six months. The last one occurred just before the patient returned to the hospital. At times the hæmorrhages amount to about one pint. During the last three years the patient has noticed a 'rotten' odor to the sputum. In March, 1904, he went to Colorado for his health. He was examined by a physician, and told that he had empyema, operation was advised. This the patient did not submit to. No tubercle bacilli were found in his sputum at this time. For some time the patient has coughed up hairs in his sputum, these are from one to six inches long. Since last March there has been some soreness over the right side of the chest. Expectoration is much more profuse when the patient is lying down. He has not lost weight.

"*Status Præsens* July 29, 1904. Temperature has been normal since admission, respirations, 20, pulse, 72, regular, of fair size and tension.

"Thorax is well formed, rather large. The left side seems slightly fuller than the right. The epigastric angle is about a right angle. Expansion is rather small, slightly less on the left side, especially on deep breathing, the difference is more noticeable in the lower part of the thorax. The clavicles are equally prominent. On percussion the apices are of equal height, about one and one-eighth inch above the clavicles. Above the second rib the percussion note is the same on the two sides. Below this level the note is somewhat hyperresonant on the right, with relative dullness throughout the left front, the *upper border of the relatively dull area sloping downward and backward into the left axilla*. Traube's space is clear. There is no

absolute liver-dulness The lung liver border is on the sixth rib in the right nipple line, it extends straight around The lung descends to the seventh rib on deep inspiration Auscultation above the right clavicle gives rather harsh vesicular breathing, with fairly high-pitched sibilant râles on inspiration, below the clavicle throughout the right side there is moderately strong vesicular with no adventitious sounds Above the left clavicle the breath sounds are obscured by sonorous rhonchi, which are heard both on inspiration and on expiration Below the left clavicle there is harsh vesicular accompanied by dry râles of medium pitch, the vibrations of which can be felt on palpation Below a line drawn from the anterior axillary fold to the left nipple the vesicular is very weak, and towards the end of inspiration a few crepitant râles are heard The auscultated spoken voice is slightly weakened between the second and fourth ribs on the left, vocal fremitus unaltered here

"Posteriorly the apices are of equal height on percussion Below the level of the spine of the eighth dorsal vertebra there is relative dulness on the left side, this is continuous with that previously described in the axilla In other respects percussion of the back is negative The upper border of relative dulness does not move with change in position of the patient Auscultation reveals fair vesicular throughout the right back and on the left back down to the dull area, where the vesicular is weak and distant Pectoral fremitus is slightly weaker on the left side over the same area Auscultation of the spoken voice is negative behind

"The apex of the heart is best felt in the fourth intercostal space in the nipple line At the beginning of the examination a pulsation was seen in the second and third interspaces, which was forcible enough to be palpated Absolute heart dulness begins on the fourth rib and extends outward to the apex, on the right it extends to the left sternal line The relative heart dulness cannot be separated from that obtained over the left lung The heart sounds are moderately strong and clear The second pulmonic is reduplicated and accentuated

"Abdomen is on a level with the ribs It looks natural The walls are quite resistant, making palpation difficult Spleen and liver are not felt Percussion is negative

"Leucocyte count 9256 on July 27, 1904 Urine examination was negative

"Sputum was examined July 31, 1904. The color was whitish-gray. Sputum had a foul odor, like that of 'bad' eggs. It separated into three layers. No tubercle bacilli were found, no elastic tissue. Later a hair was found in the sputum.

"Fluoroscopic examination shows a slight shadow throughout the left side above. Below the level of the eighth dorsal spine and extending to about the level of the eleventh dorsal there is a diffuse dark shadow, as dark as that from the liver. The entire right side is clear. A skiagraph was taken, unfortunately, the negative was poor."

Dr Senn stated that this clinical history was very full and accurate and corresponded exactly with what he had found on careful examination of the patient repeatedly after his entrance to the Presbyterian Hospital. The patient coughed up, during his residence in the hospital for a number of weeks, six or eight hairs. These hairs were very thin, lighter in color than the hair of the scalp, and varied in length from one to six inches. Sometimes, when patient expectorated these hairs, he felt a certain sensation which he referred to the base of the heart. Expectoration at times had been very copious and foetid. The patient's general condition was excellent. There was no wasting, no cachexia, hence any suspicion of tuberculosis could be abandoned without giving the chest a careful examination. He had made use of the X-ray in this case, and the skiagraph exhibited corresponded to what Dr Morris had described in the clinical history. From the clinical history, the character of the sputum, the general condition of the patient, there was no difficulty in making an absolute diagnosis of dermoid cyst communicating with the lung.

He resorted to a surgical operation for the purpose of exposing, if possible, and removing the lining membrane of the dermoid cyst. Clinical records showed at the present time almost invariably that these cysts had their location in the anterior mediastinum at a point corresponding with the location of the thymus gland. This was their favorite primary location. He therefore aimed, in operating upon this patient, to expose that portion of the mediastinum which was most frequently the seat of dermoids of the lung. He made a T-shaped incision, which remained well defined by the scar which followed as soon as the wounds had healed, largely by primary intention. He made a transverse in-

cision directly over the manubrium, and a vertical incision over the centre of the sternum. As he wanted to trephine the manubrium at a point corresponding with the location of the thymus gland, he made another or second opening two inches lower down, after reflecting the cutaneous flap and periosteum, which were separated from the sternum, and united these trephine openings by the use of a chisel, thus making an opening more than two inches in length in its vertical diameter, exposing freely that part of the anterior mediastinum which was generally the seat of dermoid cysts. The moment he opened up the anterior mediastinum by cutting through the posterior layer of the periosteum, air entered forcibly. Hæmorrhage was quite profuse. He enlarged the opening to correspond to the size of the trephine openings, and this exposed freely the anterior mediastinum. Owing to profuse hæmorrhage, he packed the large wound with iodoform gauze, and allowed the gauze tampon to remain for five or six days, when it was removed, and when he anticipated, in all probability, he would find the remains of the dermoid cyst in the expected location. In this, however, he was disappointed. In removing the tampon he found that the entire part of the anterior mediastinum which was exposed lined fairly well with granulations. He proceeded to explore the floor of the wound with the probe, but no trace of the dermoid cyst could be found. The operation had not influenced the clinical course of the disease. Before resorting to operative measures, and knowing nothing about the previous history of the case, for the purpose of locating, if possible, the dermoid cyst accurately, he resorted to exploratory punctures. He found, as Dr Morris did, an area of dulness corresponding with the upper segment of the sternum and at the base of the heart. He explored about an inch and a half from the left margin of the sternum and a little above the base of the heart to the depth of three or four inches, resorting to aspiration, gradually withdrawing the needle, but the result was negative. He found likewise a limited area of dulness which corresponded with the intrascapular region, that is, between the spinal margin of the scapula and the transverse process of the spine. In this locality he punctured, but with a similar negative result. The patient coughed now about the same as he did before the operation, so that the question arose as to what was to be done in the future. He exhibited the patient with a view of

asking the advice of the members of the Chicago Surgical Society as to the course to be pursued in the future. He could do nothing more with the anterior mediastinum. The patient had a slight area of dulness extending over the base of the heart, with a similar area of dulness on the posterior surface of the lung. He thought he had to deal here with an exceptional case. In nearly all, if not all, cases of dermoid cyst of the lung it was found to take its origin in a location corresponding with the thymus gland. That part of the mediastinum had been thoroughly explored. Nothing was to be gained by repeating the operation in that locality. He took particular care to use a probe in all directions in search for a possible sinus communicating with the supposed original seat of the disease.

The question arose now, should he resort to costal resection at a point to which the patient referred his difficulty, namely, above the base of the heart, or should he, in view of the fact that distinct physical evidence of pulmonary complications, or, at least, pleural thickening over the posterior aspect of the chest had been found, operate in that locality?

He had kept the wound open for a number of weeks with a view to studying repeatedly the condition of the anterior mediastinum, which was exposed by the operation. The arch of the aorta could be seen in the lower part of the wound. The operation wound had now completely healed, yet the patient was in the same condition as he was before operation.

### ECHINOCOCCUS CYST OF LUNG

DR SENN presented an adult man, a Greek, who came to the United States about five years ago. Six years ago he complained of acute, sharp pain, which he referred to the left side and to the upper segment of the lung. From that time on he had had occasionally some difficulty in breathing and attacks of coughing. The intrathoracic affection had evidently had but very little influence upon the general condition of the patient. He was sent to the Presbyterian Hospital by Dr Volini, a very competent physician, who gave the case very careful investigation without coming to any positive diagnostic conclusion. When patient entered the hospital his general condition was fair. On physical examination of the chest a distinct, well-defined, rather diffuse area of dulness was found over the left side and the



upper part of the lung This area of dulness was mapped out and extended from about the third rib across the upper section of the chest well beyond the left side of the nipple-line, this area of dulness being accompanied by physical signs pointing to pulmonary compression Vesicular respiration on the right side was exaggerated, on the left side very feeble, and at a point corresponding to the area of dulness there was well-defined bronchial breathing, showing that pulmonary compression was limited As this area extended well over the sternal region, a number of possibilities were taken into consideration It was believed the case might be one of dermoid in the anterior mediastinum With a view to making, perhaps, an absolute diagnosis with more direct methods of examination, he resorted to exploratory puncture a number of weeks ago He punctured at about the centre of the dull space to the depth of three or four inches, aspirating repeatedly as the needle was withdrawn, but the result was negative The same night the patient was seized with a violent attack of coughing, and coughed up about a pint and a half, if not a quart, of fluid, which represented the contents of the cyst On microscopical examination, in the sputa were found echinococcus hooklets and scolices After examining the contents of the cyst an absolute diagnosis was made of echinococcus of the lung The rupture of the cyst was followed by a violent reaction Some of the contents of the cyst escaped into the neighboring bronchial tubes, lighted up a rather severe inflammation, followed by a rapid rise in temperature, with corresponding constitutional disturbance The inflammation remained limited to the bronchial tubes There was a limited bronchitis incident to the irritation produced by the contents of the cyst The patient gradually recovered, his expectoration becoming less and less, and instead of dulness resonance was elicited on percussion A number of days after spontaneous rupture of the cyst, physical examination of that part of the lung showed distinct vesicular breathing, so that he was satisfied that, while the cyst had been punctured, he had failed to remove any of its contents, and he was strongly tempted after this, fearing that the contents of the cyst might produce fatal pulmonary or other complications, to resort at once to a radical procedure, open up and drain the echinococcus cyst The patient was very ill, and this surgical undertaking would have been a risky one, hence Dr Senn

put faith in nature's resources, waited a time, and was now fully rewarded by the conservative treatment pursued, as there was now every indication that the ruptured contents of the cyst had escaped into the bronchial tubes and would be gradually eliminated by expectoration, and that later the wound would undergo definitive healing by a gradual process of cicatrization. There was now good resonance over the entire space that was formerly absolutely dull.

Dr Senn said that echinococcus cysts were extremely common in Australia, particularly in Adelaide, and while in that country last summer he did not visit a hospital of any size without seeing from three to six or more patients who had recently been subjected to operative treatment for echinococcus cyst. He was told in Australia that the surgeons had had an enormous experience with this affection, although echinococcus cyst of the lung is comparatively rare. It affected largely the liver, then the lungs, kidneys, brain, in fact, no part or organ supplied with blood-vessels was entirely exempt. There one would find echinococcus cysts in all possible locations of the body. In Adelaide there was a case in the hospital, while he was there, in which a recent operation was performed for supposed appendicitis. Imagine the astonishment of the surgeon when he cut down upon the appendix and unexpectedly found behind the cæcum a suppurating echinococcus cyst. The operation was so common in Australia that even country physicians were anxious to perform it. It is to the Australian surgeon what the appendix is to the American surgeon. Surgeons in Australia attacked cases of echinococcus cysts fearlessly. Marsupialization was resorted to in these cases. This was a term frequently employed by Australian surgeons to indicate radical operation for echinococcus cysts and the treatment of other cysts by incision and drainage. One surgeon in Sydney, Dr Thomas Fiaschi, wishing to cut short the progress of repair in such cases, had recently closed the wound without making provision for drainage. He found that no trouble followed from pursuing this course in any of the cases, and the results were all that could be desired. When the cyst involved the upper surface of the liver, a resection of the eighth or ninth rib near the costal arch was made, and with one bold stroke of the knife a cut made through the diaphragm into the cyst, the

index-finger inserted, the cyst pulled out, a drain inserted, and the operation was finished in five or six minutes

#### DENTIGEROUS TUMOR OF SUPERIOR MAXILLA

DR SENN showed a boy, nine years of age, who was struck four years ago with a piece of ice directly over the right superior maxilla. No serious immediate symptoms followed the accident. A year later a swelling was discovered on the right side of the nose, involving the anterior wall of the antrum of Highmore. The swelling gradually increased in size, and interfered somewhat with the free passage of air through the nostril on the corresponding side. The patient entered St. Joseph's Hospital, and on examination Dr. Senn found a marked prominence on the right side of the nose involving the anterior antral wall. Dr. Senn exposed the bone by an incision along the lower border of the orbital margin and the entire length of the nose down to the end of the ala of the nose, when the bone was chiselled into, it was evident that he had to deal with an osteoma. He then resorted to resection of the upper part of the maxilla, including a part of the floor of the orbit. The tumor extended into and had largely obliterated the antrum of Highmore. As he carried his operative attack lower down in the direction of the alveolar process, he found the direct cause of the osteoplastic process in the shape of two imperfectly developed teeth. These misplaced teeth had acted as an irritant, producing a localized hyperplastic process which terminated in the formation of so-called osteoma. The wound healed by primary intention throughout.

#### LIGATION OF INTERNAL AND EXCISION OF EXTERNAL CAROTIDS FOR MALIGNANT DISEASE

DR SENN presented a patient in whom he had performed the so-called Dawbarn operation, which means the excision of the external carotid, with all its branches, in dealing with malignant disease about the pharynx or the submaxillary region. The patient was advanced in years, and was operated on two years ago for a well-defined, but limited, epithelioma of the lip. Within a year submaxillary lymphatic infection was discovered, for which a second operation was performed. A few months after the second operation there were indications of very extensive lym-

phatic infection involving the floor of the mouth and the entire submaxillary space. Through the intact skin he could discover enlarged glands along the anterior border of the sternocleidomastoid. The case was an unpromising one for further operative procedure. Through an incision which extended from the external ear forward to the symphysis of the lower jaw, and through an incision along the anterior border of the sternocleidomastoid downward to near the sternal notch, he exposed the entire field of infection. He isolated the common carotid, and followed it up to its bifurcation, he then ligated the internal carotid about half an inch above the point of bifurcation, and followed this by an excision of the external carotid with all of its branches, including in the excision all the infected submaxillary lymphatic glands, the salivary gland, the floor of the mouth on the corresponding side, and all the glands along the sheath of deep vessels of the neck. Owing to the age of the patient, he was very apprehensive at the cutting off of so much blood supply to the brain, thinking it might result in what he had observed before in some, paresis, if not paralysis, of the opposite side of the body. Nothing of that kind followed. This enormous wound healed satisfactorily, with the exception of a point at the posterior angle, where there was direct communication with the cavity of the mouth. The wound is now healed and the patient had fully recovered from the effects of the operation, and so far there were no indications of recurrence. He had performed this operation three times, and one of his patients died promptly within the first twenty-four hours thereafter. It was therefore an operative procedure, the propriety and application of which must be carefully weighed. However, in a case like the one under discussion it was an operation that was justifiable. It gave him an opportunity to remove the disease with the requisite degree of thoroughness, and he cut off so much of the blood supply in the region operated on that it weighed heavily in the balance of at least temporary success.

#### DISARTICULATION AT THE HIP-JOINT FOR SARCOMA OF FEMUR AND TUBERCULAR TENDOVAGINITIS

DR SENN exhibited pathological specimens obtained from a complicated case. Three years ago, a young man, in fair health, presented himself at his clinic at Rush Medical College, being the

subject of a large, painless swelling which involved the centre of the thigh. The swelling was spindle-shaped, and involved largely the anterior and lateral aspects of the thigh. There were no general indications of malignancy, no suspicions of an acute inflammatory process, but of a chronic affection that came on gradually and painlessly. He cut down upon this swelling and opened up a large cavity, from which he removed 262 rice bodies. These rice bodies varied in size from a pinhead to a small chestnut in the fresh state. They were structureless bodies. They were bodies which one would recognize wherever found as the typical products of tubercular inflammation. He removed all of these bodies, but this did not remove the entire swelling. There was not only this large and irregular cavity, but the femur itself was enlarged. He cut down upon it, chiselled into it, and found firm bone. This large wound healed satisfactorily, and the patient returned home satisfied with the result of the operation. About a year and a half later he returned. The swelling then had changed in its character. There was no fluctuation. This time there was a solid, firm, cylindrical swelling involving distinctly the shaft of the femur and encroaching well up towards the hip-joint. The clinical evidence pointed clearly to malignancy. He accordingly resorted to disarticulation at the hip-joint. The wound healed by primary intention. A year later he again returned, and Dr. Senn was puzzled with the appearance at the site of the former operation. He found a typical stump, such as one would expect after a subtrochanteric amputation of the thigh, but the hospital records said "amputation through the hip-joint." He then removed by a very difficult operation this stump, which proved to be a bony mass which had formed immediately below the acetabulum since the disarticulation of the thigh. The stump was immovable, due to the fact that this large mass of bone had formed extensive connections with the ischium, which had to be severed with a chisel. The site of the former acetabulum was very shallow, the tumor was connected with the ascending and descending ramus of the ischium, and there was a reformation of the periosteal sarcoma in the soft tissues after disarticulation of the thigh. The patient again recovered promptly.

A section under the microscope gave the histologic features of a spindle-celled periosteal sarcoma.

EXTENSIVE PLASTIC OF FACE AFTER OPERATION FOR  
CARCINOMA OF ORBIT, NOSE, AND FACE

DR SENN exhibited some illustrations showing an extensive plastic operation after a radical operation for malignant disease of the orbit, where the eye had yet remained intact, but the disease extensively involving the orbit had destroyed a part of the nose and a considerable portion of the face. A very extensive operation had to be made. He took a flap, the size of a hand or larger, from the parietal region, with which to cover the enormous defect. These cases were usually very fatal, but this particular case demonstrated that sometimes in apparently hopeless cases in performing a radical operation one is rewarded with unexpected results. The patient returned three years later with a recurrence which involved a small part of the left ala of the nose which was left after the operation, and this small carcinoma was excised.

## RECTOPLASTY FOR EXTENSIVE TRAUMATIC DEFECT

DR SENN described a case in which by the accidental discharge of a shot-gun the patient lost about one-third of the anus, the whole posterior wall of the rectum, and the entire coccyx. Two operations were performed for the purpose of correcting the enormous prolapse of what remained of the rectum, but with negative results. Dr Senn exhibited a photograph which showed the appearance of what remained of the rectum before operation. It showed well the enormous rectal prolapse. In this case he separated the margins of what remained of the rectum on both sides from the cicatricial connections sufficiently free, so that the vivified margins could be readily brought together, sewed, first, the entire thickness of the bowel wall with bronze aluminum wire, buried this row of sutures with two rows of catgut, leaving about two inches of the bowel and anus to be restored by a second operation. There was primary union of the first wound, and the wound at the second operation healed throughout, with perfect restoration of the sphincter muscle, and complete correction of the prolapse.

## SCAR CARCINOMA IN REGION OF GREAT TROCHANTER

DR SENN detailed the history of a patient, sixty-seven years of age, who had an abscess in the subtrochanteric region some

thirty-two years ago Two years ago there was a beginning carcinomatous process in the scar, with rapid extension of the disease and extensive undermining of tissues, so that he had to remove a very large part of the soft tissues, including the carcinomatous undermined ulcer, which gave rise to an enormous defect which he had to cover He then made a transverse incision down to the deep fascia, extending from the sacro-iliac joint to the large vessels, dissected up the two large triangular flaps, and brought them together with sutures without harmful tension Healing of the enormous wound retarded by a superficial infection, sections under the microscope showed the typical structure of scar carcinoma

#### FRACTURE OF HUMERUS, WITH POSTERIOR DISLOCATION OF UPPER FRAGMENT

DR SENN exhibited a Rontgen illustration of a fracture of the humerus in the middle of the shaft, and asked particular attention to the condition of the shoulder-joint The patient suffered from a severe accident, one in which a revolving shaft had twisted the arm and brought about the fracture, with injury of the shoulder-joint Judging from the skiagraph, there was no dislocation of the humerus, the skiagraph being taken anteroposteriorly The head of the humerus was shown at its proper level apparently in the glenoid cavity An enormous swelling followed the accident, so that, when the patient was brought to the hospital, it was feared he was at the same time the subject of laceration of some large blood-vessel By resorting to extension by weight and pulley and immobilization, in the course of two weeks the enormous swelling disappeared, and then it became evident there was something wrong with the shoulder-joint He then found, without the use of the Rontgen ray, a dislocation of the head of the humerus backward A skiagraph was taken from the side, which showed distinctly the existence and character of the dislocation He then resorted to reposition, elevating under an anæsthetic the arm, and making on the upper fragment extension in an upward and forward direction, so as to relax the untorn portion of the capsular ligament The first attempt failed, but the second succeeded in effecting reduction This case showed that one could not always rely upon the Rontgen ray if the skia-

graph was taken from one direction in demonstrating the existence or absence of a dislocation of the shoulder-joint

## SECONDARY SUTURE OF ULNAR NERVE AFTER GUNSHOT INJURY

DR SENN presented a man who had received a charge of bird-shot at close range, the shot penetrating the soft tissues at the inner aspect of the forearm below the elbow-joint, tearing away the ulnar nerve and artery with the muscles surrounding them. Suppuration set in, and there was a long tedious process of healing. When Dr Senn saw the patient, eight months after the injury, there was complete paralysis of the territory supplied by the ulnar nerve, that is, the little finger and the ulnar side of the ring-finger, with characteristic contracture of the fingers. He excised the entire skin scar, exposed the ulnar nerve in the groove behind the internal condyle, followed it down to the massive deep scar tissue, expecting every moment to lose the track of the nerve, but was fortunate enough to dissect in the proper direction until he found the intact part of the ulnar nerve on the distal side some distance from the scar. He had then two inches of doubtful tissue. Was it all scar tissue, or was a part of the nerve incorporated in scar tissue? He relied upon a small neuroma which pointed out the termination of the proximal end, and following the cord downward excised the scar tissue, and resorted to secondary nerve suture with catgut, stretched both ends of the nerves, brought them together without tension, and dressed the arm in a flexed position. The wound healed by primary intention, and four days after the operation there was a return of sensation in that branch of the ulnar nerve which supplies the ulnar side of the ring-finger. When he examined the patient two days ago he found returning sensation extending down to the distal end of the first phalanx, showing rapid regeneration of nerve tissue, and probably perfect reunion, with restoration of function eight months after the original accident.

## THE SURGICAL TREATMENT OF MUCOMEMBRANOUS AND ULCERATIVE COLITIS, WITH SPECIAL REFERENCE TO TECHNIQUE

DR J E SUMMERS, JR, of Omaha, Neb, read a paper with the above title, for which see page 97.



## DRAINAGE IN ACUTE SPREADING PERITONITIS

DR VAN BUREN KNOTT, of Sioux City, Iowa, read a paper with the above title, for which see page 75

DR M L HARRIS stated that his experience in reference to exclusion of portions of the intestine had always been limited to exclusion with drainage into the intestine. He had resorted to this method in several cases in which the cæcum and ascending colon were involved, and always with success. He had always made use of the method of dividing the ileum and transplanting it into some portion of the colon distal to the trouble which he sought to relieve. The colon was always left free, so that it could drain. He believed this was an essential feature, and thought that complete exclusion of any portion of the intestinal tract should never be undertaken.

Concerning the Fowler position, he thought it had been thoroughly demonstrated that it had distinct advantages and was quite commonly used by surgeons in cases of general peritonitis. The drains which he had used had been the soft rubber ones made with the rubber dam which corresponded practically to the large tube mentioned and exhibited by Dr Knott.

DR JACOB FRANK called attention to the fact that the first colostomy done for this disease was performed in 1885, by Folet, of Lille, France. The patient lived five days, and then died. In 1887, Drs Durante and Novara did the same operation, with recovery of the patient.

As to antiperistalsis, previous to 1882, there was considerable debate among physicians and surgeons as to whether or not such a thing could occur. In 1882 he published the report of a case in the *Medical Record*. In this case he fed the patient beef-tea and milk by the rectum, and patient vomited these. When his attention was directed to this, he made observations, and found that this was the case. Dr Albert Bernheim, of Philadelphia (*Journal of the American Medical Association*, February 16, 1901), in an article on "Movements of Intestines," records his observations on dogs into whose rectum he injected undigestive material. In the great majority of cases the dogs vomited the material injected. He stated this before the Section on Surgery of the American Medical Association at the Saratoga meeting, when Dr Ochsner claimed that, by giving enemas or feeding per rec-

tum, there would be no peristalsis, and the speaker at that time claimed that there was such a thing as retroperistalsis by injecting foods or liquids into the rectum. He was glad that Dr Summers brought this point out. If he was not mistaken, it went so far as the small intestine, but he thought by further investigation there would be found cases where it comes out by the stomach.

With reference to exclusion of the bowel, in some of the cases reported before the Chicago Surgical Society, it was demonstrated that in that part of the bowel which was excluded there were masses formed from the secretions or excretions from the mucous membrane. These masses consisted of small balls of cheesy substance filling up the excluded bowel. He did not think it was safe to close up both ends, as he had demonstrated this in dogs.

In regard to Dr Knott's paper, he had tried the methods mentioned by him, and in two cases of diffuse septic peritonitis he filled the abdomen with salt solution, put the patients in the Fowler position, and used glass drainage-tubes, sitting them up in bed with a back-rest, and both recovered. These were the only two cases of diffuse septic peritonitis that he had ever had recover in his surgical practice of twenty years.

DR DANIEL N EISENDRATH showed the photograph of an apparatus which had been in use in the Michael Reese Hospital for the past two or three years for the treatment of cases of diffuse septic peritonitis. The apparatus was designed by one of the head nurses. It consisted of a U-shaped arrangement upon a little pedestal, and by means of adjustable screws it can be raised to any height. The photograph showed a patient in the Fowler position. He thought this apparatus had advantages over using tables, chairs, or anything of the kind at random, as one could more accurately get the Fowler position, knowing how high this was. It was an advantage over the propping up of a patient in bed, for those who had had experience with such patients knew that in their weakened condition they would slip down.

Prior to the time of the use of the Fowler position the mortality from cases of diffuse septic peritonitis was practically 100 per cent. About a year ago, when he began to use the Fowler position systematically, and to flush cases of diffuse septic peritonitis thoroughly with hot salt solution, using three to four

gallons in each case, he changed his mortality from 100 per cent practically to a large per cent of recoveries. This, he agreed fully with Dr Knott, was due in a great measure to adopting the Fowler position. He mentioned three cases in which he obtained successful results by this treatment. In one case he used a Mikulicz drain, which was perhaps the most satisfactory drain. In one of them the use of the Mikulicz drain was supplemented by a glass drain.

There had been some discussion as to whether these cases should be flushed or not, and whether one ought to use large quantities of salt solution or to eviscerate. He did not believe these cases should be eviscerated. He believed that flushing with salt solution accomplished the best results.

To illustrate the diversity of opinion, some would recall a discussion on appendicitis which took place last June at the meeting of the American Medical Association, held at Atlantic City. At this time Dr Murphy stated that his mortality in sixteen cases by means of non-irrigation of diffuse septic peritonitis was one in sixteen. In other words, there were fifteen recoveries out of sixteen cases by opening them up, putting them in the Fowler position, and flushing. In the same discussion Dr Mordecai Price stated that he was using nothing but his famous dipper and Schuylkill River water, and of seventeen cases of diffuse septic peritonitis treated by flushing, he saved all, so that one method, the speaker thought, seemed to be as successful as the other.

DR ALEXANDER HUGH FERGUSON said, with regard to the enlargement of the ileocecal valve in chronic constipation, and the ill results of chronic constipation, as suggested by Dr Summers, he had looked over this subject very thoroughly at one time, and thought he was the first to attempt to enlarge the ileocecal valve for chronic constipation, but found that several others were ahead of him.

In a spreading inflammation of the peritoneum, one should not forget where the focus of the inflammation was when he began to drain. The Fowler position, which had been so much lauded and recommended, and properly so, should not supplant every means of drainage of the abdominal cavity. There were three positions from which pus emanated that should not be drained by the Fowler position. Take, for instance, the gall-

bladder region, Morrison's pouch This pouch could not be drained with the patient in the upright position, and if it did drain pus by the upright position, with a phlegmonous and perforative inflammation of the gall-bladder, it would be a deleterious, if not fatal, thing for the patient, by carrying that material down into the peritoneal cavity The patient should, therefore, be in the horizontal position and drainage established anteriorly or laterally at the tip of the twelfth rib, so that one could lay the patient on the side, and this pouch, which would hold about a pint of fluid normally, would be emptied, and there would be no chance for the fluid to trickle down among the small intestines over the transverse bowel An abscess of the liver may burst into the same region, and then the Fowler position is contraindicated Perforation of the duodenum not infrequently took place in this same region, which needed to be drained laterally and not downward

DR SUMMERS remarked, as to the first colotomy for colitis, referred to by Dr Frank, the best article ever written on mucomembranous colitis, was by W Hale White, of Guy's Hospital This article is in Allbutt's "System," and the date of the first operation was given therein He was told by a surgeon, who had visited India, that English surgeons there had been operating for years on cases of mucomembranous disease of the large intestine, and this disease was supposed to be due to the climate In "Hill Diarrhœa," when the sufferer got out of the hills, the disease disappeared On the other hand, if he remained there long enough, mucomembranous colitis sometimes developed, and it was similar to that which is met with after dysentery

With reference to retroperistalsis, as mentioned by Dr Frank, he thought it did not occur in the small intestine, that the preponderance of evidence was against it

Three or four years ago he read a paper on the Gibson fistula, as he had done a lot of work along that line, and had then referred to the Weir method When one wanted to flush, a large opening was needed If one could make a large valvular fistula which would be competent he could flush freely through it He had always succeeded in doing that, and had removed the appendix because it was a good thing to do under the circumstances

As to operating on the ileocæcal valve for constipation, to

which reference was made by Dr Ferguson, he referred to Mr Lane's article on angulations, which might occur on both the right and the left sides, and form obstructions which could not be overcome except by switching the small intestine over into the large one. In some cases he thought this might advantageously be done. Some years ago Dr Wm J Mayo operated on the ileocaecal valve for the relief of constipation, but these operations were failures. Operating on the ileocaecal valve or changing its form to stop constipation was puerile from the point of view of the author's paper, particularly with reference to its effect on digestion.

As to perforation of the duodenum, referred to by Dr Ferguson, the speaker had two such patients at present convalescing in the hospital, and said that if the surgeon did not get the patient into the right position, and forgot about Morrison's pouch, he was apt to lose the case. In one of these, large quantities of fluid were found in Morrison's pouch. The patient had not only been given morphine hypodermically, but had had several drinks of whiskey, which had leaked, together with the other stomach contents, into the abdomen, and could easily be recognized even in the fluid from the pelvis. If, after opening the abdomen in these cases, the drainage in Morrison's pouch had not been established, together with pelvic drainage, he thought he might have lost the patients.

With reference to Dr Knott's paper, he would say that Dr Knott was so thoroughly convinced of the utility of the plan advocated in treating cases of diffuse peritonitis, that he operated upon his own son eighteen hours after an operation for perforative appendicitis by another surgeon. Dr Knott had himself operated in the absence of a colleague, an acute peritonitis having developed. The extra median incision, toilet, and drainage established saved the boy's life.

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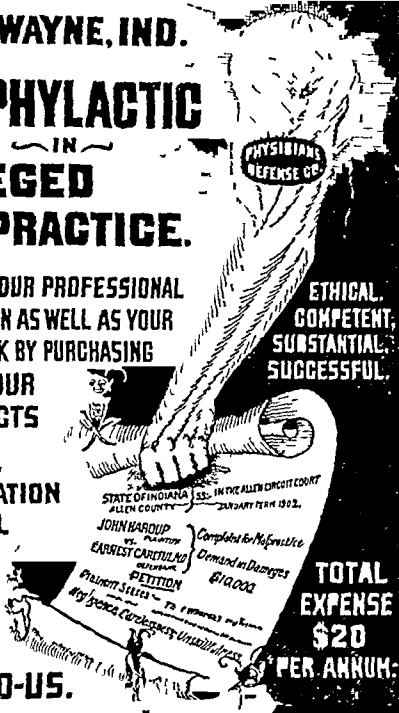
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\$10,000

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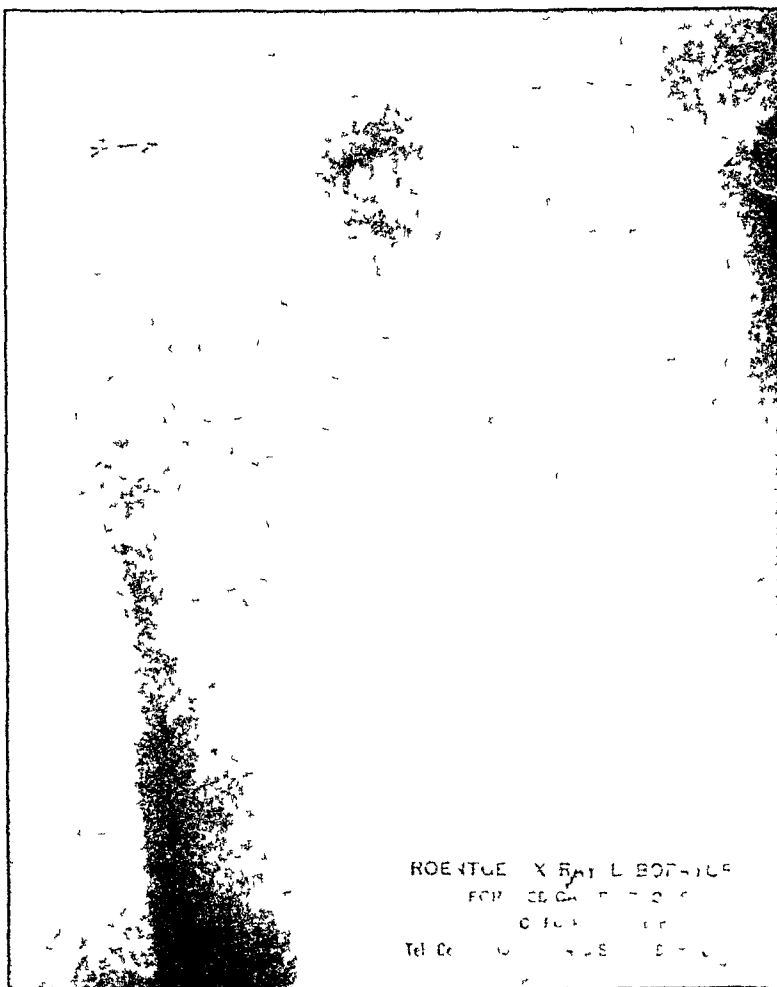
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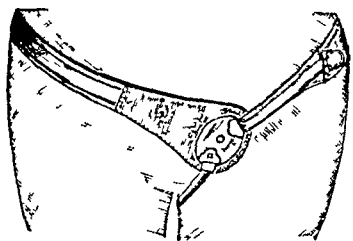
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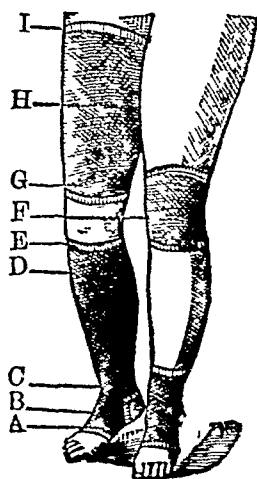


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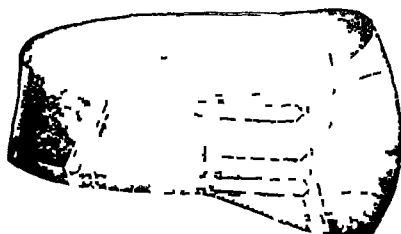
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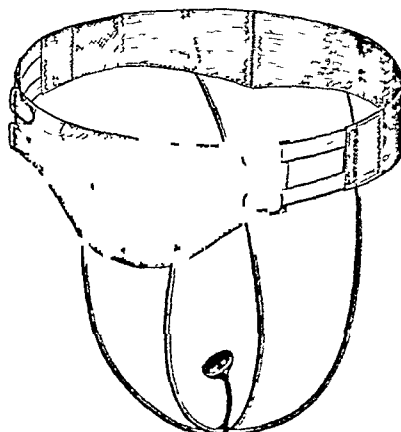
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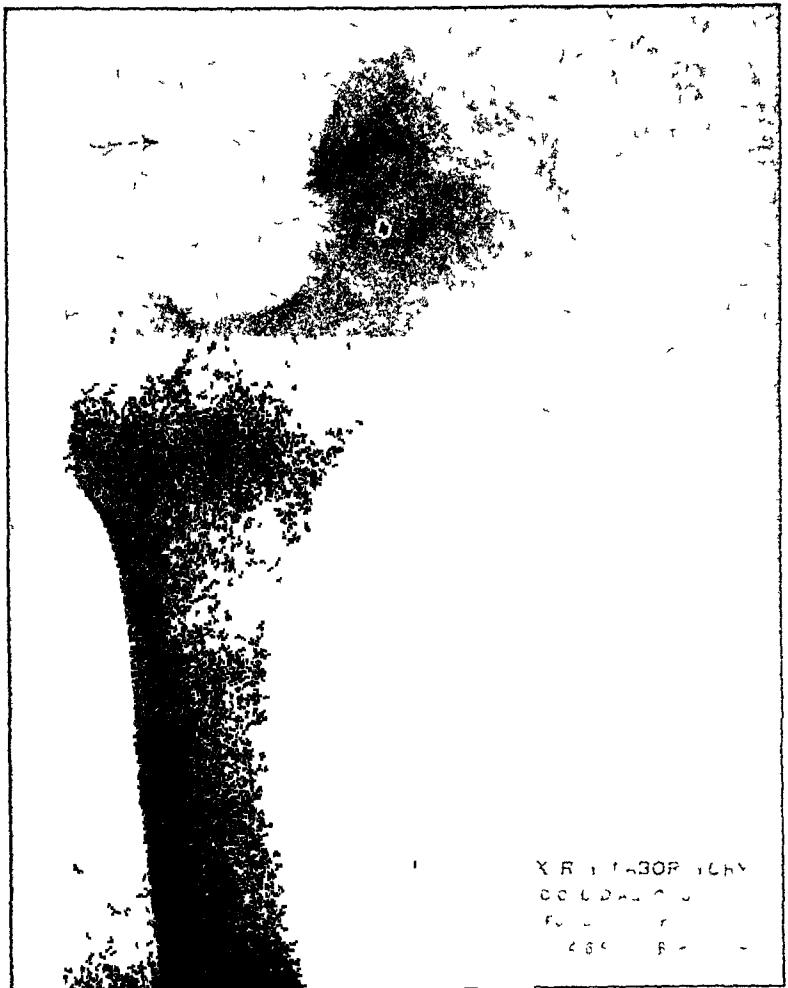
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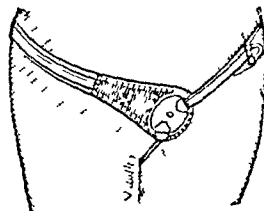
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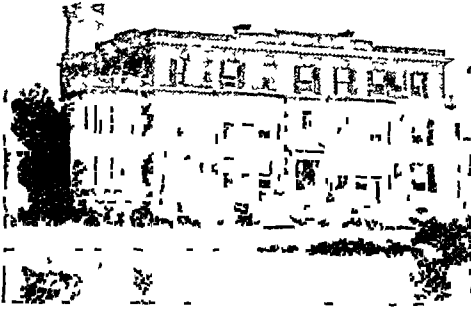
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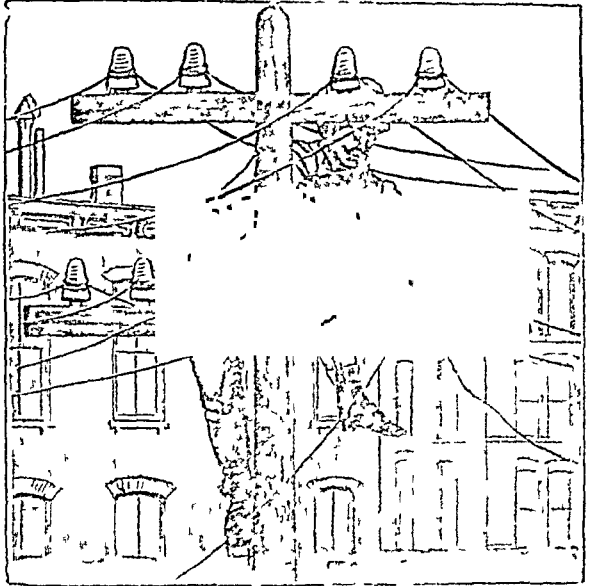
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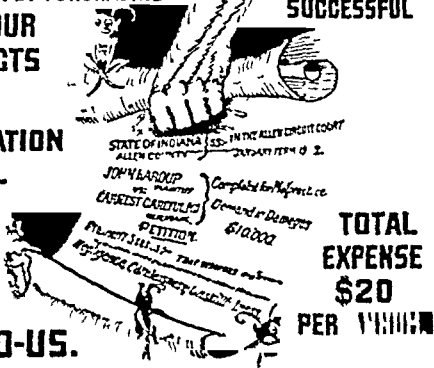
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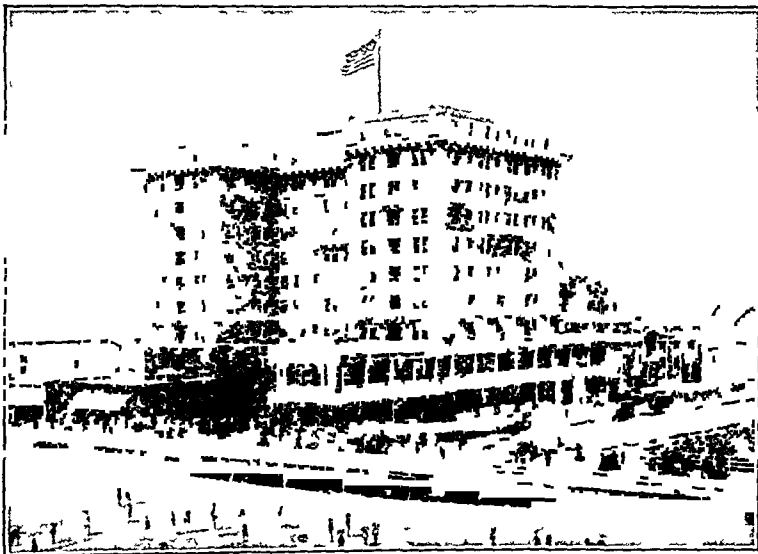
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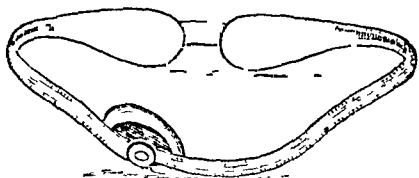
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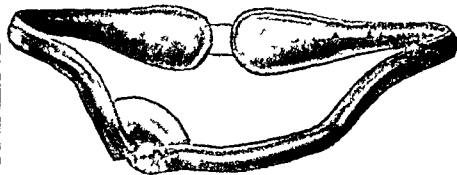
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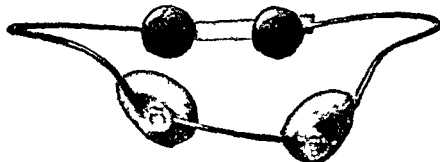
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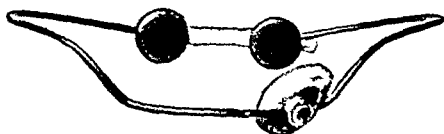
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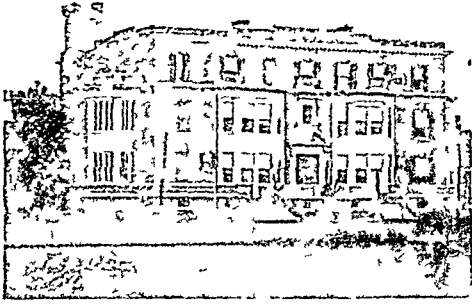
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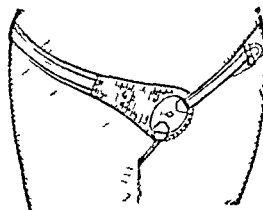
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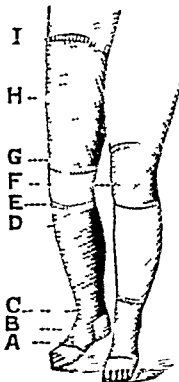
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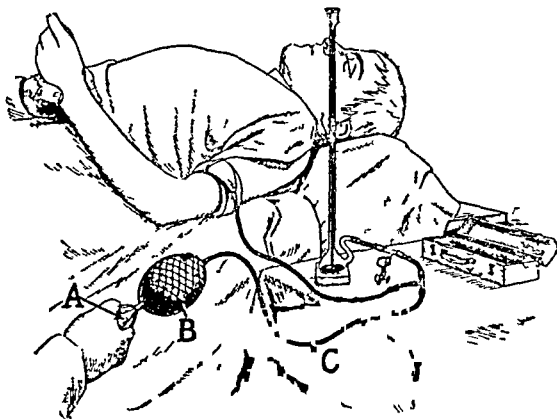
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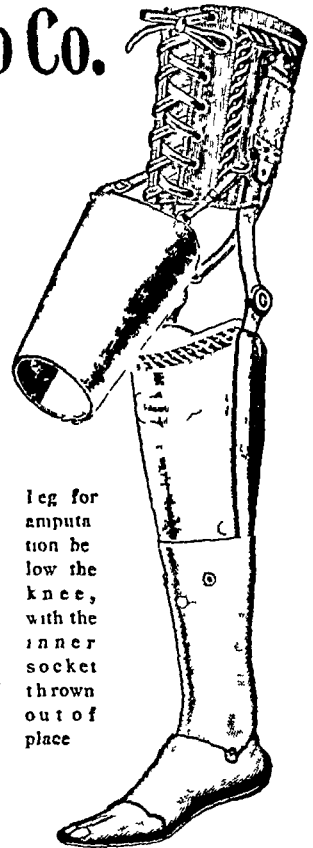
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# ANNALS OF SURGERY

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## ORIGINAL MEMOIRS.

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### A REVIEW OF FIVE HUNDRED CASES OF GASTRO-ENTEROSTOMY, INCLUDING PYLOROPLASTY, GASTRODUODENOSTOMY, AND GASTRO-JEJUNOSTOMY.<sup>1</sup>

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THE writer has included in this series all of the cases in which there has been an incision made into both the intestine and stomach and plastic union established between the two organs with the intent to increase gastric drainage. The term gastro-enterostomy is used in its literal sense, the formation of an artificial passage between the stomach and intestine, the terms pyloroplasty, gastroduodenostomy, and gastrojejunostomy being used as expressing more accurately the exact method employed.

The series of cases have been worked out with a view of showing the actual results of operation both as to mortality and the percentage of secondary operations. The method of computing mortality herein followed is to charge as a death from operation every case dying in the hospital without regard to cause of death or length of time after. It includes cases dying as long as three months after operation, from coincident chronic nephritis, etc., and might be called the combined mor-

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<sup>1</sup> Read before the American Surgical Association, July, 1905

tality of operation and disease This works a hardship on the statistics, but it eliminates the personal equation The statistics include every case Dr Charles H Mayo and myself have operated upon up to June 20, 1905, the early cases showing a particularly high mortality The secondary operations were repeated in some instances two to five times before good results were obtained, so that the number of such procedures was nearly double the number of cases reported

Pyloroplasty, 21 cases No deaths Seven secondary operations ( $33\frac{1}{3}$  per cent ) Gastroduodenostomy, Finney, 58 cases, four deaths (6.9 per cent ) Two secondary operations (3.4 per cent )

Gastrojejunostomy Total, 421 Benign, 307 cases, 19 deaths ( $6\frac{1}{2}$  per cent ) In the last 140 there were four deaths, a mortality of  $2\frac{6}{7}$  per cent , last 80 gave but one death One hundred and fourteen malignant, with twenty-one deaths (18 per cent ) Of these 114 cases, 63 were in connection with pylorotomy and partial gastrectomy, with eight deaths (13 per cent ) The very unfavorable cases of cancer obstruction were subjected to gastro-enterostomy, so that this operation gives a higher mortality than radical excision In the last 40 gastrojejunostomies for malignant disease the mortality was 8 per cent In the 421 gastrojejunostomies there were 21 reoperated cases (5 per cent )

### PYLOROPLASTY

The pyloroplasty of Heinicke-Mikulicz, in our experience, has but little risk in suitable cases, but it is open to objection It enlarges the caliber as much in an upward direction as downward in the line of drainage, and the extent to which this enlargement can be carried out is limited The pylorus, following this operation, is exceedingly prone to become adherent, so that the opening remains at a high level The stomach, if greatly dilated, must elevate the food to the high lying outlet, and it frequently happens that the degenerated muscle fibres are incapable of the muscular effort, and, as a result, the patient is not materially benefited In three cases

we fastened the pylorus, after operation, to the region of the umbilicus by suture, to secure a low drainage point, taking advantage of the fact that adhesion after operation was the rule, to secure fixation at a more favorable situation. These three cases have continued in good health, but there are valid objections to the plan. In the seven cases which came to secondary operation, the adhesions were most marked. Gastro-jejunosomy in each case resulted in cures. In the remaining 14 cases, cure resulted. In four cases, an ulcer was excised at the same time with favorable result. Pyloroplasty has a small field of usefulness, but in performing it the later plan of Mikulicz should be adopted. The incision should be curved downward upon both the stomach and duodenum, much like the Finney method, the result being to give an increased caliber over pyloroplasty as ordinarily performed, and establishing better drainage lines.

The principle in plastic union, established by pyloroplasty, is one of the first importance and widely used in surgery. It is especially valuable in choosing the line of closure after excising gastric ulcers, etc.

#### GASTRODUODENOSTOMY

Strictly speaking, this operation implies a separate opening between the stomach and duodenum, such as the Kochei operation, but, as the method of Finney more easily answers the same purpose, we have followed this plan in the entire group of 58 operations, with four deaths and with two secondary operations. (Mortality, 6.9 per cent. Secondary operations, 3.4 per cent.) In the first 46 cases there was only one death, in the next 12 there were three deaths. It does not seem fair to count two of the deaths, as one was from pneumonia after complete recovery and one from embolus due to an old endocarditis. We had an opportunity to re-examine the operated field in three individuals after a number of months, there were extensive adhesions present in two.

Subjects for this operation should be carefully selected, extensive disease, adhesions, a short gastrohepatic omentum,

and especially the presence of scar tissue, should be considered a contraindication, as it is in just these varieties that gastrojejunostomy gives the most satisfactory results. Two of the four deaths we had were due to suture leakage on account of tension in scar tissue.

In open ulcer the food must still pass the ulcer area to reach the pylorus, and ulcer does not depend on obstruction, as shown by the frequency of duodenal ulcer beyond the possibility of obstruction. Reasoning on this ground, we would not expect the curative results from gastroduodenostomy in active ulcer which we would get from gastrojejunostomy made to the left of the ulcer-bearing area, and our experience bears this out, in this class of cases it has not given the same measure of relief. The importance of this objection is somewhat minimized by the fact that the line of enlargement is not only downward in the line of drainage, but also along the greater curvature, which is seldom involved in ulcer. The opening can be made of ample size, and it avoids the risks habitual to gastrojejunostomy, as it leaves the outlet at its proper situation. We were enabled, in four cases, to combine with the Finney operation an excision of the ulcer. In selected cases this Finney method is the one of choice.

There were two secondary operations in this group, in both individuals bile came into the stomach, causing distress. We had made the opening too large, as shown at reoperation. One case had severe hæmorrhage from insecure suturing, and required reoperation in twenty hours, with recovery.

#### GASTROJEJUNOSTOMY

Gastrojejunostomy, 421 cases. Benign, 307 cases, 19 deaths (6 per cent). Secondary operations, 20 ( $6\frac{1}{2}$  per cent). Malignant, 114 cases, 21 deaths (19 per cent). One secondary operation 0.9 per cent. Of these operations, 63 were made in connection with pylorotomy and partial gastrectomy.

The writer has been greatly interested in gastrojejunostomy. No operation in surgery has conferred greater benefit

upon suitable patients than this one. Unfortunate experience, however, sharpened the investigation as to the causes of deaths and the complications which we found to be more or less inherent in every method with which we became acquainted. In all but three of the fatal cases, a post-mortem examination as to the cause of death was obtained.

It has only been of late that we have secured a method which could be depended upon to give good results steadily with a sufficiently low mortality to justify its employment in cases in which disability, rather than impending death, was the spur to operative relief.

The first claim to investigation comes with the question, Shall the operation be made anterior after Wolfler, or posterior after von Hacker? Of the total number of cases, 126 were anterior and 295 posterior. The mortality in the anterior group was somewhat over 1 per cent higher than in the posterior, but the percentage of secondary operations was greater after the posterior operation. The mortality comparison is, however, hardly fair to the anterior method, as this group comprises a larger number of the early operations in which inexperience can be blamed for some of the misfortunes.

For benign disease, the posterior operation is the one of choice. It is applied at a higher point on the jejunum, and is unattended with the risk pertaining to the presence of the loop which must surround the transverse colon. That this loop is of dangerous import is shown by two of our secondary operations, in one of which a number of feet of small intestine travelled through the noose, and in the second, death was directly traced to adhesion and obstruction of the transverse colon. The length of this loop is from sixteen to twenty inches, a disadvantage when one considers the proportionally high value of the upper jejunum in digestion and absorption. The anterior operation has some few indications. In cancer the disturbance is less, and, as the gastric juice has little acid, the patient cannot be expected to live long enough to develop a secondary jejunal ulcer. The anterior operation is more liable to be followed by contraction on account of the traction weight



of the attached jejunum, a diverticulum formation of the intestine takes place which is followed later by contraction. This happens most frequently after the button, as the line of union is narrow and it has less of a grasp on the tissues. Contraction, however, is liable to occur after any form of operation, especially if the pylorus is unobstructed. With an open pylorus nature tends to close the opening, no matter what form of operation, but the shorter the loop, the less the probability of contraction, and in the operations without a loop we would not consider it a serious question. We have seen a reduction of one-half take place three and five months, respectively, after a Moynihan operation on a nine-inch loop.

Vicious circle, as the regurgitant vomiting is generally known, is less liable after the anterior than the posterior operation. The traction weight of the attached intestine tends to keep the bowel pulled away from the stomach, while, after the posterior operation, there is a greater tendency for the development of a kink or flattening of the intestine against the opening (Cannon and Blake). In spite of the objections which we present to the anterior operation, we have a large number of operated cases after this method in perfect health for periods of time up to twelve years.

Angulation and obstruction are the two great causes of regurgitant vomiting, and, in our experience, the short, posterior loop of from seven to ten inches gave the greatest number of such complications. Acute, vicious circle occurs very rarely, if the opening be placed at the lowest point of the gastric cavity, but a considerable number of patients begin to have trouble, usually, within two or three months, as pointed out by Ochsner. This condition often increases, and in from six months to a year gives sufficient annoyance to require a secondary operation.

*Murphy Button* Total, 157 operations. Benign, 72 operations, 6 deaths (8 per cent), 54 anterior, 4 deaths (8 per cent), 4 reoperations (8 per cent). Eighteen posterior, 2 deaths (11 per cent), 4 reoperations (22½ per cent).

Malignant, 85 operations, 15 deaths (18 per cent), including pylorotomy and partial gastrectomy.

The Murphy button is least liable to be followed by passage of bile into the stomach. While in position, it mechanically prevents kinking, and the character of the permanent opening does not favor angulation. Four of the deaths were caused by pulling apart of the attached surfaces in from six to ten days subsequent to operation, and after the button had passed along the intestine. We now always protect the button union by four or five mattress sutures of silk at intervals. A continuous suture outside the button may prevent its passing out of position and cause it to lodge and act as a foreign body. If it were not for the frequent retention of the button in the stomach, the posterior button method, without a loop, would be ideal. Twice we have had to remove a retained button for symptoms. After pylorotomy and partial gastrectomy for cancer, we nearly always employ the button. It gives an immediate opening and is particularly free from secondary complications. In one out of three direct anastomoses by the Kocher method, between the duodenum and stomach after partial gastrectomy, a second operation was required in eight weeks to relieve angulation and obstruction.

*McGraw Ligature* Total, 36 operations. Benign, 17, 2 deaths (11.7 per cent). Malignant, 19, 3 deaths (15.7 per cent). We have used Ochsner's technique and found it very satisfactory.

The McGraw ligature method anterior has been very free from bile regurgitation and is exceedingly safe. It can be placed in bad tissues and can be used in poor subjects. We have four times used this operation with a hæmoglobin of less than 25 per cent, once 20 and once 24 per cent, in bleeding ulcer, with recovery, once with the hæmoglobin 24 per cent in cancer with acute obstruction, with recovery, once with hæmoglobin of 10 per cent in cancer with hæmorrhages simulating ulcer. The latter case was scarcely conscious at time of operation. He lived three days, and, although a stout, heavy rubber cord was used and tightly tied, there was no sign of an opening at the postmortem. It requires some vitality to cause the tissue to cut through. This man did not

have sufficient resistance to set up atrophy necrosis, and the result was the same as in a cadaver. Two cases of cancerous obstruction with a considerable quantity of free fluid in the abdomen recovered after a ligature operation. Tissues which are of poor vitality, but which have some power of repair, will do so after a McGraw ligature. The button might set up an uncircumscribed slough, or the suture become easily infected, if these methods were chosen. The McGraw operation, including opening and closing the abdomen, can be done in twelve minutes, without hurry. The disadvantages are, that it should be, or has been, used with the loop, and, like any loop operation, the opening may contract. Again, it does not allow of immediate feeding. This fact and the uncertainty of the time of the ligature cutting through render the method one for the occasional rather than the average case. We had one case of acute regurgitant vomiting after the McGraw ligature, which was reoperated on the fourth day. The ligature had been badly placed and the opening lay at one side of the centre of the bowel.

*Posterior Suture* —Total, 228 operations. Ten malignant, with 2 deaths (20 per cent). Two hundred and eighteen benign, with 11 deaths (5 per cent).

We do not do an anterior suture operation. The increased risk of contraction and jejunal ulcer which unavoidably attends the anterior method would, with the suture, also increase the chances of bile regurgitation.

In May, 1901, Mr Robson demonstrated in this country the bone bobbin operation, with the suture on a posterior ten-inch loop. We did fifteen by this method, with one death, and found it very satisfactory.

In June, 1903, we began the method of Mikulicz, making the opening within three or four inches of the origin of the jejunum and using a transverse incision. We made forty-three by this method with four deaths, two of which could be fairly excluded. Four required a second operation at our hands, and to a large extent because we departed from the originator's technique. It came about in this way. The transverse intes-

tinal incision limits the size of the opening to one-half the diameter of the intestine, less about one-fourth inch suture line, and the opening could seldom be made larger than could admit the invaginated thumb. We tried to enlarge this by encroaching on the bowel, and caused a valve to form, which turned the bile into the stomach. These patients gave us a lot of trouble, the short upper limb of the loop made an ordinary entero-anastomosis of the two arms of the bowel impossible. We finally united the intestine each side of the opening in exactly the same manner as the Finney operation at the pylorus. The result was good. This was our first experience with the short proximal loop, the cases which recovered after this method have remained in splendid condition, despite the small opening. In October, 1903, Dr. Charles H. Mayo did two operations with a longitudinal, intestinal opening without a loop and as short as possible, practically the operation we are doing now. Both recovered and remain well.

In the summer of 1903 Mr. Moynihan demonstrated to us the method he was using with the clamp, and which goes by the name of the "Moynihan Operation," using the oblique, posterior incision of the stomach wall and a nine-inch loop. The use of the clamps simplified the technique, and the opening could be made very large. We made fifty-three after this method with three deaths. The primary results with the Moynihan operation were good. Not a case of acute vicious circle, but in the course of a year seven cases required a second operation for the distress caused by bile regurgitation, either occasionally in large quantities or frequently in smaller amount. In June, 1904, we began the operation on the Roux principle, doing a posterior gastro-enterostomy on a nine-inch loop with entero-anastomosis. The proximal loop was then obstructed (*a*) by Scott-Matolli suture, (*b*) Fowler's silver wire, (*c*) division of intestine, turning in both ends after Doyon. There were forty-eight of these, with two deaths. Two required a second operation, in one the silk suture in the longitudinal pleating had passed into the intestine. The infection caused adhesions, angulation, and bile regurgitation. In the second, in which the

proximal intestine had been divided, the cut end intussuscepted through the upper part of the lateral anastomosis, causing obstruction. This complicated operation was of too serious a character to apply to every case, requiring from forty-five to fifty minutes for its performance, and on January 1, 1905, we began the routine use of the posterior suture operation without a loop, in the same manner as used in the two cases operated upon by Dr Charles H Mayo in October, 1903.

The operation of choice is without a loop. Fifty-six operations, 1 death (1.8 per cent.)

This operation became popularized by the writings of Peterson, of the Heidelberg clinic, Czerny having used it for years, usually with the Murphy button, and with splendid success. At the time Peterson brought out the favorable features of the method, we had practically abandoned the button for the suture in benign disease, and the operation could not be easily done with a longitudinal opening without the holding clamps, which Moynihan and Littlefield later popularized. Mikulicz, as already pointed out, was doing the operation with the transverse incision.

To properly appreciate the advantages of the "no loop" method, some physiological and anatomical facts must be understood (Fig. 1). The stomach is not a bag, but a muscular organ, and when empty the pylorus is not far from the lowest point, and lies nearly in the median line of the body. As the stomach distends, the organ becomes more nearly horizontal by the elongation of the greater curvature. The pylorus passes to the right of the median line and relatively passes above the greater curvature. The gastro-epiploic artery sets away from the greater curvature about three-fourth of an inch, when the stomach is empty, and sends its gastric branches upward on the anterior and posterior gastric wall, which it meets above the actual line of the greater curvature. This arrangement of the blood-vessels enables rapid distention of the stomach, without interference with the blood-supply. The lesser gastric curvature is more fixed in position and can be divided into two parts, the perpendicular portion which drops



FIG 1—Showing posterior wall of the stomach drawn through a rent in the transverse mesocolon. Note slight separation of gastrocolic omentum from its attachment to the stomach, permitting anterior wall of stomach to appear, and insuring drainage at lowermost level. Black lines mark site of proposed anastomosis, the jejunum shows at its origin.

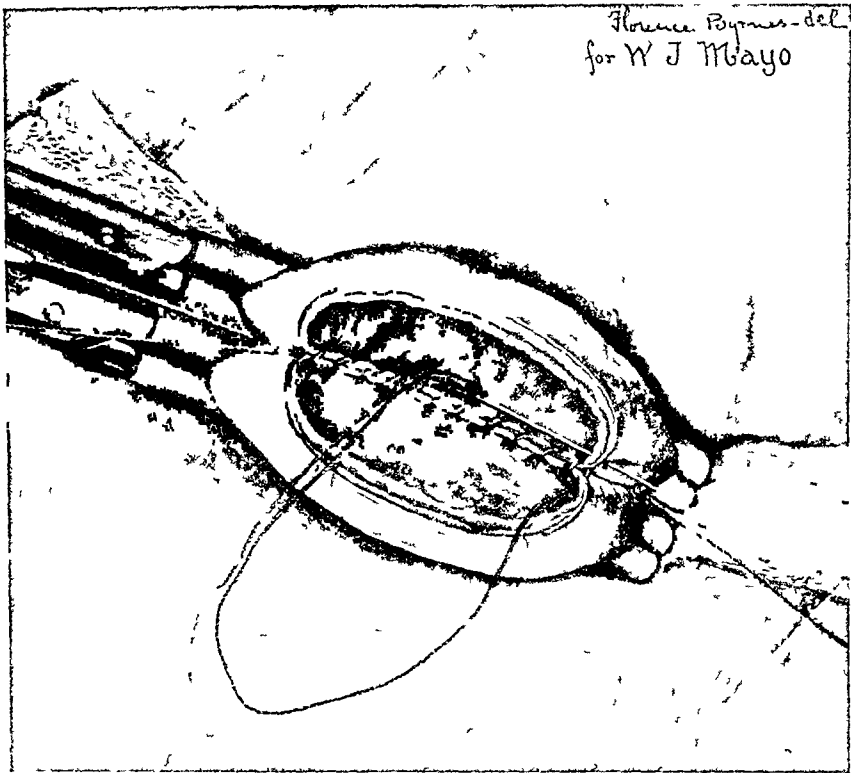


FIG 2—Forceps in place and anastomosis half completed by suture

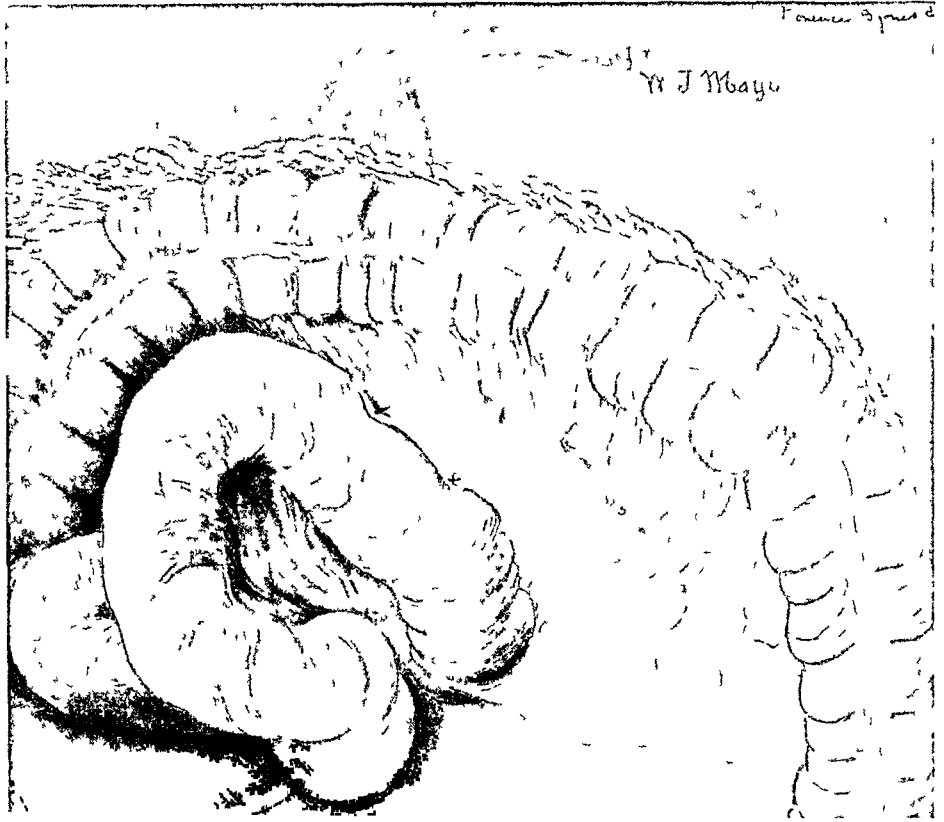


FIG 3—Completed operation from behind margin of torn mesocolon attached by several interrupted sutures to line of union,



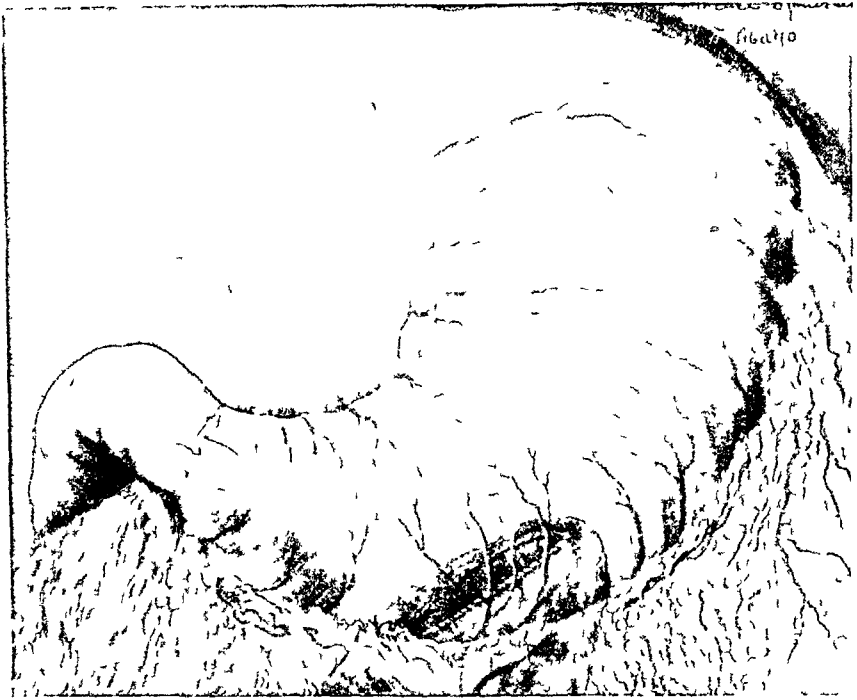


FIG 4 —Completed operation from in front. Anastomotic opening shows through as darkened area on posterior wall. Note that it goes to the bottom of the gastric cavity and slightly anterior, as indicated by suture line in the omental attachment.

nearly vertically from the right margin of the cardiac orifice (about one and one-half inches to the left of the mid-line), and the horizontal or slightly curved portion, which turns sharply to the right and ends at the pylorus. Ordinarily, the concavity of the lesser curvature is from two to three inches, the corresponding point on the greater curvature being three and one-half to four and one-half inches, making the convexity of the pyloric segment. This is the grinding muscular portion of the stomach, the part subjected to the greatest amount of traumatism, and over 80 per cent of all the lesions for which we are called to operate are either in this part or in the first two and one-half inches of the duodenum. The gastrojejunal opening should be placed just to the left of this portion of the stomach (Fig 2). The inferior margin of the gastrojejunostomy should lie at the greater curvature, on a line opposite the juncture of the transverse and longitudinal parts of the lesser curvature. This is rather farther to the right than has usually been practised. The duodenum passes through the mesocolon, nearly on a perpendicular plane with the cardiac orifice, one and one-half inches to the left of the mid-line, and when the stomach is empty its lower border lies nearly on a line with the origin of the jejunum. When the gastric cavity is distended or dilated, it descends and covers this point. The proper situation of the gastric opening should be oblique on the posterior wall, beginning on the body of the stomach between the lesser and greater curvatures, and extending downward to the very bottom of the stomach—Moynihan's line (Figs 2 and 3). To insure that the opening shall be at the very lowest point at its right margin, we slightly separate the omentum from the greater curvature and pull one-fourth inch of the anterior wall out posteriorly, pushing the gastro-epiploic vessel out of the way (Fig 4).

In previous contributions to this subject we have called attention to the changed nature of the proximal arm of the jejunal loop after gastrojejunostomy. It becomes succulent and thick. With the loop operation, the food could and did pass into the proximal arm, while the peristalsis of this short

end was inefficient, and herein lay most of the difficulties Peterson developed the fact that if the jejunum were attached short without a loop, it would require a reverse peristalsis to carry food into the duodenum. Peterson's point of jejunal election lies within from one to three inches of the origin of the jejunum, varying as necessary to enable easy attachment to the stomach (Figs 1 and 2). It will be noted that the line of proposed union is a natural one. The jejunum attaches to the stomach without kink or bend in the line of gastric activity (distention and contraction). The intestine comes off the bottom of the stomach as though it were mortised on, the opening extending upward and to the left. As Cannon and Blake have experimentally proven, and we have clinically demonstrated, the food will pass out of the unobstructed pylorus after any method of gastrojejunostomy, with this method of operation it makes little difference. Spasm of the whole pyloric end of the stomach which quickly follows ulcer or other irritation no longer holds back the food and secretions. The gentle compressing action of the cardiac end is quite sufficient to turn the secretions and delayed ingesta out the gastrojejunostomy. Relief of the pyloric obstruction, no matter its character, permits normal progress. Interruption of this calls the new opening into use. It is not at all necessary for the chyme to enter the duodenum to stimulate pancreatic and biliary discharge. This happens whenever the gastric product enters the small intestine at any point. In all the loop operations, more or less of the jejunum, at its most important situation, is thrown into a by-channel. The opening of the common duct lies four inches below the normal pyloric entrance of food. This operation brings the common duct opening eight inches above the gastrojejunal food entrance, and the constant presence of biliary and pancreatic alkaline secretions will certainly render secondary jejunal less frequent than primary duodenal ulcer.

To recapitulate

(1) The gastric opening should be placed on the posterior wall, obliquely from above downward, and left to right (Fig 1) (Moynihan's line)

(2) The lowest point of the gastrojejunostomy should be at the lowest point of the stomach, on a plane perpendicular with the cardiac orifice (Fig 1)

(3) To insure this effect, the gastric incision should extend one-fourth to one-half of an inch onto the anterior wall (Nos 1, 2, 3, and 4)

(4) The incision in the intestine should be longitudinal, opposite the mesentery, and begin from one to three inches from the origin of the jejunum, measuring on the anterior surface (Peterson's point of election, Figs 1, 2, and 3) The exact distance depends on the ease of attachment, as short as can be conveniently done without tension

A description of the operation is, briefly, as follows

(a) The abdominal incision is made four inches in length, three-fourths inches to the right of the middle line, the fibres of the rectus muscle being separated. The lower end of the external wound lies opposite the umbilicus. This opening also enables inspection of the duodenum and gall-bladder and is reliable against hernia when closed

(b) The transverse colon is pulled out and the mesocolon made taut by traction upward and to the right, in this manner bringing the jejunum into view at its origin

(c) About three to four inches of the jejunum opposite the mesentery are drawn into a slightly curved clamp. The handles of the clamps should be to the right, to enable a short grasp on the intestine. Three-fourths of the circumference of the bowel is pulled through, the posterior border is not included, to prevent entanglement of the suture with the redundant posterior mucous membrane. The holding clamps are applied sufficiently tight to check hæmorrhage and prevent extravasation of intestinal contents

(d) The ligament of Treitz is a short muscular mesentery covered by a variable peritoneal fold (too variable for a reliable landmark) extending upward from the origin of the jejunum on to the mesocolon. This peritoneal fold lies at the base of the arterial loop of the middle colic artery which supplies the transverse colon. The mesocolon is opened within the vas-

cular loop and the posterior inferior border of the stomach pushed through. A small separation of the greater omental attachment to the stomach enables the anterior gastric wall to be drawn out posteriorly. The posterior gastric wall is drawn into a clamp, with the handles to the right, in such a manner as to just expose the anterior wall at the base.

(e) The two clamps are laid side by side and the field carefully protected by moist gauze pads. With fine, celluloidal linen thread, on a straight needle, the intestine is sutured to the stomach from left to right by a Cushing suture at least two and one-half inches.

(f) The stomach and intestine are incised one-sixth inch in front of the suture line and the redundant mucous membrane excised flush with the retracted peritoneal and muscular coats. With a No. 1 chromic catgut on a straight needle, the posterior cut margins of the entire thickness of the gastric and jejunal wall are united by a button-hole suture from right to left, at the extreme left the suture changes to one which passes through all the coats, of each side alternately, from the peritoneal to the mucus, then directly back on the same side from the mucus to the peritoneum. This acts as a hæmostatic suture, and also turns the peritoneal coats into apposition. It passes around the anterior surface and is tied to the original end, which has been left long for the purpose. If silk or linen is used for this suture, it may hang *in situ*, suppurating for months.

(g) The clamps are now removed and the linen thread continued around until it is tied to the original end, firmly catching the blood-vessels in sight along the suture line. The parts are carefully cleansed and inspected. If necessary, a suture or two is applied, to accurately coapt or to check the oozing.

(h) The margins of the incised mesocolon are now united to the suture line by three or four interrupted sutures, and the parts returned into the abdomen.

*After-Treatment* — On being placed in bed, a glass female douche point is passed just above the internal sphincter ani.

attached to a gravity bag filled with one-half strength normal salt solution. The elevation should not be greater than six inches. The small stream passing into the rectum is readily absorbed without irritation. One or two quarts are taken up in an hour. (Murphy.) The patient is then placed in the semi-sitting posture. Beginning at sixteen to twenty hours, an ounce of hot water is given every hour, this is rapidly increased, and in thirty-six hours the usual experimentation with liquid feeding is instituted. Rectal feeding is unnecessary. The operation is, in all of its essential parts, that of Mr Moynihan.

We are much indebted to Munro and Bottomly, of the Carney Hospital, Boston, for suggestions in technique, as elaborated above, and for the opportunity they have afforded Miss Burns to make the drawings, herein shown, from actual operations at their hands.

# SPLENECTOMY FOR MYELOGENOUS LEUKÆMIA

REPORT OF LATER HISTORY OF A RECOVERED CASE, AND ULTIMATE DEATH FROM LOCOMOTOR ATAXIA

BY MAURICE H RICHARDSON, M D,

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IN an article on the Surgery of the Spleen, by Dr Warren, the details of the following case were published, with remarks upon it by Dr Whitney (see ANNALS OF SURGERY for May, 1901) In brief, the case is as follows

Mrs E M D, a patient of Dr J F Croston, of Haverhill, I saw on December 12, 1900 In February, 1900, she first noticed a bunch in the left side of the abdomen When I was called to see her, I expected, from the history, to find an ovarian tumor with twisted pedicle The patient's mind had been prepared for operation, and everything was in readiness for it Under ether the tumor was clearly an enlarged spleen The outline was characteristic, the spleen was freely movable, the patient was in excellent condition

No examination of the blood had been made, and none was at the time possible The patient had, with the greatest reluctance, consented to operation The physician and the family were sure that she could never again be brought to consider an operation,—a conviction which subsequent experience showed to be correct

The question whether to remove the spleen or not had to be decided upon the spot The enlarged spleen might mean any disease of that organ associated with great hypertrophy All splenic tumors are necessarily serious, excepting, perhaps, the chronic enlargement seen in malarial districts In some tumors of the spleen extirpation promises well for permanent cure, in others the outlook is practically hopeless Without prolonged study of the case and careful blood examination, it was impos-

sible to give any opinion of value as to which class this tumor might belong

The question of operation was carefully but briefly considered. The possibility of a myelogenous leukæmia was the most conspicuous feature of this case. I had seen many such cases, in none of which did extirpation of the spleen present the least hope of success. Indeed, I had never seriously considered operation.

In the present case, even if the spleen was a part of a leukæmia, its great mobility promised an easy and bloodless operation. If there was no leukæmia this spleen in the absence of malarial history belonged to the class of anæmias, and extirpation would give every chance of success.

I decided to operate, for if ever a splenectomy in myelogenous splenic leukæmia could be justified by prospective ease of technique, it would be in this case. The favorable prognosis as to operation gave hope that at least the successful extirpation of a leukæmic spleen would aid in settling definitely the real value of surgical treatment. However discouraging the experience of others had been in the removal of the spleen, it had been no more unsuccessful than medical treatment had always proved eventually.

The spleen was quickly removed without the loss of a teaspoonful of blood. The specimen was examined the next day by Dr. Whitney, and the diagnosis of splenic myelogenous leukæmia was made. His report was as follows:

"SPLEEN. Leukæmia. The spleen was removed by Dr. M. H. Richardson on December 12, 1900, and was received within three hours of the time of its removal and while yet warm. It was very much enlarged, weighing 2275 grammes, and measured 25 centimetres in length by 16 in width and 9 in thickness. Its shape and form were, in general, regular, but on one part of the surface there was a slight depressed area measuring 4 centimetres in greatest extent, and of a deep yellow color. This was evidently the result of an anæmic necrosis. Otherwise, the spleen presented no remarkable appearance externally. The capsule was smooth and of normal color. It was of moderate firmness.

"On section, it was uniform in texture and of a pale grayish red color. The openings of the vessels were visible, the follicles not to be made out with the eye, and the trabeculæ only here and there to be seen. At the hilus was a large vein filled with a loose grayish red thrombus. The blood which came from the vessels was of a pinkish red color and



formed rather loose coagula. Lying at the hilus, attached to the spleen, was a small lymph-node the size of a bean, and another a little larger had been removed separately.

*"Microscopic Examination"*—The spleen was hardened in Zenker's fluid and stained in various ways. With a low power the follicles were seen as occasionally widely separated accumulations of lymphoid cells which stained deeply. Between them the spleen pulp was very much increased, the openings of the veins were prominent and could be readily detected. On examination with a high power numbers of large mononucleated cells were found lying in the meshes of the reticulum associated with eosinophiles in large numbers. The reticulum was not increased in thickness, but the spaces seemed to be dilated, and in this way the increase in bulk was brought about.

"The examination of the lymph-nodes showed the lymph channels filled with large mononuclear cells, among which were occasional eosinophiles. The medullary strings were replaced by similar tissue, but less compact, and in which were very numerous eosinophiles and large multinucleated protoplasmic masses (giant cells). There was only a narrow zone of lymphoid tissue to be found in the periphery. The infiltration in the gland had apparently taken place from the hilus outward.

"Microscopic examination of the blood, taken at the time of the operation, showed the characteristics of an advanced leukæmia, viz, myelocytes, largely increased number of eosinophiles, and the presence of macrocytes and microcytes, together with numerous megaloblasts and normoblasts. The absence of lymphoid cells was noticeable. Examinations of the blood, made at short intervals until a month after removal, showed essentially the same features without any material change, except in the last examination, January 10, there appeared to be fewer myelocytes in proportion to the polynuclear leucocytes. There was no increase in the lymph elements."

The patient made a quick recovery, and was soon up and about. She improved wonderfully in health, and became able to perform her household duties and to enjoy life.

The blood was repeatedly taken and examined by Dr Jones, who spent much time in the care and study of this case.

The patient early began to object to the taking of blood for examination, though every effort was made to induce her to consent. The more that was done for her, the more obstinate and suspicious she became.

For two or three years she seemed in perfect health. The family moved about the State, and was very difficult to trace. Finally, the patient came under the care of Dr F W Anthony, of Haverhill, who, in February, 1904, reported as follows:

"The patient has been quite well since the operation, except

for a profuse flow every two weeks. This flow continued up to four months ago, since when there has been none. Her knees have been painful for some time, but are better now. Seven months ago she began to have attacks of profuse nose-bleed, which occurred every two or three weeks, and later she had attacks of rectal hæmorrhage, at intervals of three or four weeks. A short time ago she noticed pain and swelling of the left fourth metacarpal, with spontaneous fracture. The right wrist has been swollen at times. The eyesight has been poor for seven months. The left optic nerve is nearly, the right entirely, destroyed. There are no knee-jerks. The Argyll-Robertson reaction is present. There has been difficulty in walking, but no general ataxia, rather a general muscular weakness. The patient has been completely blind for two weeks. She is now stupid and sleeps most of the time. She does not want to be touched or disturbed in any way."

Dr Jones made another attempt to get a specimen of the blood, but without success.

On November 16, 1904, Dr Anthony reported

"In a general way I saw her in 1903. She had then a typical locomotor ataxia, absent patellar reflex, ataxia of station and gait, eyesight nearly absent, spontaneous fracture of one or two fingers, painless swellings of several joints, general weakness. She complained of no abdominal symptoms. She declined all interference, even to the extent of obtaining a drop of blood for examination, and died the picture of death from locomotor ataxia."

I regret exceedingly that I am unable to present the details of this patient's final condition. A few things are, however, worthy of mention. The first important fact was the great improvement in the blood which followed the operation. It became normal. How long the blood continued so, I cannot say. It was probably for some time, for her general health was apparently restored. There was no greater improvement, however, than is seen occasionally in the regular course of the disease under medical treatment. We cannot, therefore, claim for the operation the improvement seen in this case.

The second fact is the distressful condition that the patient was in for some months previous to her death. I did not

see her, but she was reported by Dr Jones and Dr Anthony to be a great sufferer. It is a question whether her condition was worse than is usual in such cases. I do not know. It could not, under any treatment, have been any worse than it was. I do not think, however, that it is any fairer to assume that the late bad condition was the result of the operation than to assume that the early improvement was the result of it.

It seems to me a more reasonable assumption that the extirpation of the spleen had no effect upon the disease, one way or the other, early or late, that the improvement noted was the result of medical treatment following the operation, that the final break-up was the natural course of the disease.

Finally, I would say that if the early success of this case has encouraged others to extirpate a spleen in myelogenous leukæmia, it has done distinct harm. That the case may no longer be quoted as a case of successful operation in this disease, it has seemed important to publish the ultimate result. It is to be regretted that the patient could not be studied, and that no autopsy was made.

It is quite possible, of course, that my conclusions are unwarranted. A disease in which successful extirpations of the spleen are so unusual that the very success of the operation is to some minds the strongest evidence against the diagnosis, —in which almost the only successful operation has been followed, after temporary improvement, by a distressing death, —such a disease must by common sense be removed from the category of surgical affections, even if there is, as in this case, no positive proof that the final bad result is directly dependent upon the operation itself.

## ON RUPTURE OF INTESTINE

WITH REPORT OF A CASE IN WHICH RUPTURE OCCURRED  
FROM MUSCULAR ACTION, AND RECOVERY FOLLOWED  
OPERATION

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RECOVERY following operation for peritonitis resulting from the escape of matter from the digestive tract is daily becoming more frequent. As in perforation resulting from typhoid or tubercular ulceration, so in cases of traumatic rupture are our statistics becoming more and more encouraging.

In 1887, Curtis, in an exhaustive essay on this subject, including experiments on anæsthetized dogs and on the cadaver, was able to show that such rupture occurred in the vast majority of cases through crushing the bowels against the vertebral column. Curtis also analyzed 116 cases pathologically, but was able to report no cases of successful laparotomy and repair or recovery. In 1888, Mr Croft, before the Clinical Society of London, reported a case where he had been able to prolong life for one month through making an artificial anus at point of rupture. This patient eventually died of exhaustion, being unable to stand the shock of the operation undertaken to close the opening. In 1890, however, the same surgeon was able to report the first case of recovery, and collected fourteen cases of operation undertaken with this object. From this time the cases of recovery came even more frequently, and by 1894, Mr Battle, of St Thomas's, was able to collect 15 further cases of operation with 9 recoveries. Since then, up to the end of 1904, I have been able to collect 12 recoveries from English and American literature, while the French yields 11 (out of 26 operations) and the German 9 (out of 32 operations). Gage, in 1902, was able to collect 85 cases of rupture of bowel occurring since 1887, or since the previous large collection by Curtis. In 40 of these operations

TABLE OF CASES OF RUPTURED INTESTINES OR MESENTERY TREATED IN THE WARDS OF THE  
MONTREAL GENERAL HOSPITAL DURING THE PERIOD 1895-1905

ALL CASES WERE MALES

| Date | Age | Cause                                                                                            | External Symptoms   | Main Symptoms                                                                                                                              | Operation             | Post Trauma | Lesions Present                                                     | Result                     | Cause of Death       |
|------|-----|--------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------|---------------------------------------------------------------------|----------------------------|----------------------|
| 1898 | 30  | Collision on bicycle                                                                             | Bruise and hematoma | Temperature 97° F, pulse 104<br>Shock Constitutional signs of hemorrhage, vomiting, dulness in flanks                                      | Laparotomy and suture | 3 hours     | Ruptured small bowel, mesentery, superior mesenteric artery         | Death 5 hours, post trauma | Hæmorrhage           |
| 1899 | 36  | Kick from a horse                                                                                | Slight ex coriation | Temperature 96° F, pulse, 72 (rapidly rising), unconscious, pain and tenderness Rigidty of recti, tympany with dulness in flanks, vomiting | Laparotomy and suture | 20 hours    | Ruptured small bowel and omentum                                    | Died 30 hours, post trauma | Pertontitis          |
| 1899 | 48  | Kick from a man, was admitted 36 hours post trauma, and would not consent to immediate operation | None                | Temperature 99° F, pulse 100 36 hours post trauma, signs of general peritonitis                                                            | Laparotomy and suture | 40 hours    | Ruptured ileum                                                      | Died 84 hours, post trauma | Pertontitis          |
| 1902 | 32  | Fell 40 feet on back and side                                                                    | None                | Pain                                                                                                                                       | None                  |             | Ruptured mesentery                                                  | Died 9 hours, post trauma  | Hæmorrhage           |
| 1903 | 50  | Struck with knotted rope                                                                         | Bruise              | Temperature 96° F, pulse uncountable, shock, pain                                                                                          | None                  |             | Ruptured stomach, jejunum, liver                                    | Died 1 hour, post trauma   | Hæmorrhage and shock |
| 1904 | 20  | Kick by horse                                                                                    |                     | Temperature 100° F, pulse 90, unconscious, vomiting, dulness in flanks                                                                     | Laparotomy and suture | 36 hours    | Ruptured jejunum                                                    | Died 60 hours, post trauma | Pertontitis          |
| 1904 | 56  | Fall with timber and machinery                                                                   |                     | Temperature 98° F, pulse 90 18 hours post trauma, pain                                                                                     | None                  |             | Ruptured intestine (complete), mesentery, urethra, fractured femora | Died 24 hours              | Hæmorrhage           |
| 1905 | 48  | Lifting heavy weight                                                                             | None                | Temperature 96° F, pulse 84 (rising), pain, rigidity                                                                                       | Laparotomy and suture | 6 hours     | Ruptured ileum, mesentery                                           | Recovery                   |                      |

had been performed and in 17 recovery took place. Such figures are, however, at best misleading. Few report their unsuccessful cases, and many are diagnosed only postmortem, so that the percentage of recoveries falls much lower when compared with the post-mortem records of the various clinics whence they are reported.

In an analysis of 2443 autopsies which have been performed at the Montreal General Hospital since 1883, a period of twenty-two years, rupture of one or more abdominal viscera had taken place in 53, 63 organs being injured, spleen, 18 times, liver, 15, small bowel, 10, bladder, 12, left kidney, 5, right kidney, 2 pancreas, 1. Up to the present time 10 cases of ruptured small bowel have occurred, and all have proved fatal with present exception. This would give us a percentage of 9.09 per cent recovery, which, though likely also to prove incorrect, must be nearer the mark than the 42 per cent quoted by Gage, and which corresponds closely with Riegner's figures from the Allerheiligen Hospital zu Breslau where, out of 12 cases, 1 recovered from operation. (Cases dated from 1893.)

Strangely enough, eight of our cases have occurred within the last ten years, or in 13,060 surgical admissions figures which are more nearly correct for centres where a large emergency service is to be found. In five of these operation was performed with recovery or 12½ per cent (see Table).

The following case is of interest both on account of his recovery, and more especially on account of the manner in which the lesion took place. I wish here to express my thanks to Dr J. Alex. Hutchison, of this hospital, in whose wards the case occurred, and through whose courtesy I was enabled to carry out operation and treatment.

L. M., aged forty-eight years, an Arab, had always been well, but several weeks previous to admission had thought he might be "ruptured." Had in consequence visited a drugstore and bought a truss, which he has since worn. He never noticed a swelling in this region, and had no confirmation of his idea save that of the drug clerk and the fact that at times he felt uncom-

fortable in the inguinal region. Shortly after a moderate meal on April 19, 1905, he returned to work baling cotton. His companions being otherwise engaged, he attempted to lift a bale, weighing some 200 odd pounds, by himself. As he strained to lift, he had a sudden severe pain in abdomen, and was obliged to lie down at once, crying out on account of pain. The pain continued, and after a few minutes he was conveyed to the hospital in an ambulance. The ambulance surgeon thought a swelling in the right groin was present, but could not confirm it, but on arrival at hospital no hernia was present. At this time, three-quarters hour post trauma, the temperature was  $96\frac{2}{5}^{\circ}$  F, pulse, 84. Patient was perfectly quiet and rational, but excited and anxious on account of the pain, which continued severe.

On examination nothing positive was discovered save a tenseness of the recti abdominis. He was kept under observation for four hours, during which period his temperature rose to  $103^{\circ}$  F and his pulse to 104. The pain, now accompanied by slight tenderness, continued, as did the muscle spasm, indefinite dulness in right flank. The patient vomited once. On these signs, a diagnosis of "peritonitis" was made, "probably due to a rupture of the bowel."

The patient was prepared, and under ether anæsthesia the abdomen was opened below the umbilicus in the median line. A peritonitis most marked in the right lower quadrant of the abdomen was present. On exploring the internal ring of the right inguinal canal this was found enlarged, and a sac present, but no contents. The bowel in this neighborhood was first examined, and here a rupture in the long axis of the gut, large enough to admit a lead-pencil, with everted mucosa, was found. In the mesentery underlying this loop was a transverse tear two and one-half inches long. The contents of the bowel had escaped and were escaping, a moderate quantity of blood-clot was present, though all active hæmorrhage had nearly ceased. No sign of strangulation, bruising, or injury other than the above tears could be discovered. The rupture was closed with two purse-string followed by a layer of straight Lembert sutures, the abdomen flushed out with large quantities of warm saline solution, and closed without drainage. The patient made a recovery interrupted only by a slight superficial infection. The rupture was determined to be about the centre of the ileum.

Recovery was due, I feel, to early operation, and to the fact that it was not necessary to make a prolonged search for the rupture. The fact that a second rupture was not present was evidenced by the peritonitis being confined to the half-dozen loops of bowel in the neighborhood of the lesion found. Cultures taken at operation, although from escaped intestinal contents, showed, for some unknown reason, no growth.

Von Mikulicz and Kausch refer to rupture of the bowel through much strain—"sehr heftige Anspannung der Bauchmuskeln," and Mr Thomas, in the *British Medical Journal*, 1894, reports a case occurring apparently from simply lifting a chair, but so far as I have been enabled to learn, these cases are rarely diagnosed ante-mortem, and no reported case so occurring has recovered. Bunge, of Königsberg, at the last Surgical Congress in Berlin, April, 1904, called attention to this variety, and reports a case not dissimilar to the above, as well as one resulting from a fall on a flat, smooth surface, the injuring force being thus similar in both. He has brought forward for the first time the importance of a hernia being present in these cases, and one can readily conceive that, when contents are present in a hernial sac the free movements of the bowels may be interfered with, allowing a less active force an opportunity for inflicting damage usually caused, as has been repeatedly demonstrated, by a force of small dimensions travelling with high velocity, *e g*, a kick from a horse.

A diagnosis in this case was reached through an interpretation of no one symptom, but of the symptom-complex, which includes, briefly expressed, signs of shock, gas, fluid, inflammation in the peritoneal cavity, mainly, however, through the severe initial pain, which continued, and especially to muscular rigidity which also continued. This latter fact is important, as it is not infrequent to find cases, which have sustained abdominal blows exhibit a tenseness of the abdominal muscles shortly after injury, which, however, disappears within an hour or so. It has been our habit here to trust much to this sign in all cases where solution of continuity of the gut comes in question, and, though undoubtedly sometimes at fault, more



especially in cases of typhoid perforation, yet no sign deserves precedence French surgeons have perhaps insisted on this more than those of other nationalities Hartman reports 37 cases *contusio abdominis*, in 17 of which this sign was present, and in all these rupture was demonstrated Peritonitis should be well started in six hours, and, except in cases where leakage is directly into the pelvis, much may be trusted to this sign Vomiting is an invaluable adjunct, but too often long delayed

This adds, I venture to hope, another grain to the scale of professional opinion in favor of early operation Petry, in 1886, reported that of 160 cases of rupture into small bowel, 11 got well, 10 with abscess formation, and cases are recorded which have lived some time (three weeks) postoperative, and died from secondary perforation of abscess, but among surgeons to-day the question is but one of time when to operate Shock is a serious drawback, no doubt, but much of its terrors are overcome by the use of ether anæsthesia Peritonitis and hæmorrhage are more serious items A review of literature dealing with this subject affords us a striking instance of advance in abdominal surgery, and, in view of recent increase in reported recoveries, yields us, I trust, a not unwarrantable satisfaction of *eiga facta pro bono humano* .

#### CASES OF RECOVERY SINCE 1894

- KNAGG British Medical Journal, 1904, 832, 1 recovery  
 MACDONALD Albany Medical Annals, 1897, 1 recovery  
 BUCHANAN ANNALS OF SURGERY, 1900, 1 recovery  
 LUND, NICHOLS, and BOTTOMLEY Boston Medical and Surgical Journal, 1902, cxlvii, 584, 4 recoveries  
 ELLIOT ANNALS OF SURGERY, 1901, 34, 293, 1 recovery  
 WIGGIN New York Medical Journal, 1894, 1 recovery  
 WALSHAM Lancet, 1899, 1 recovery  
 WATSON American Journal Surgery and Gynæcology, St Louis, 1897-8, 1 recovery  
 SCUDDER Boston Medical and Surgical Journal, 1 recovery  
 CAHIER Societe de Chir de Paris, 1902, 1 recovery  
 GUINARD Revue de Chir, 1897, 3 recoveries  
 REOBLANC Ibid, 1897, 1 recovery

LE DENTU Ibid, 1897, 3 recoveries

Societe de Chir de Paris, 1899, 3 recoveries

KIRSLEIN Deutsche Zeitschrift fur Chirurgie, 1900, 8 recoveries (up to 1900)

RIEGNER Deutsche Zeitschrift fur Chirurgie, 1902, 1 recovery

Thirty-two in all, to which undoubtedly there are uncollected cases to be added

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# THE MANAGEMENT OF CERTAIN CRITICAL CASES OF INTESTINAL OBSTRUCTION, WITH REPORT OF CASES<sup>1</sup>

A RESECTION FOR CANCEROUS OBSTRUCTION, B RESECTION  
FOR GANGRENOUS INTUSSUSCEPTION, C RESECTION FOR  
GANGRENE DUE TO MESENTERIC THROMBOSIS

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For several years now, since the perfection of the technique of intestinal anastomosis, surgeons have been much disappointed at the results of resection in certain critical cases of intestinal obstruction, and especially in cases of obstruction due to cancer of the intestine. It is well known that the mortality of these operations under the prevalent method of enterectomy with immediate suture is 50 per cent at least in the hands of the best surgeons, and in some hospitals is as high as 85 per cent. In cases of resection for gangrene of the intestine the mortality is even higher. The principal cause of death has been septic peritonitis, due sometimes to contamination by intestinal contents at the operation, but more often to the fact that the most perfectly placed sutures or mechanical devices do not hold. It is hardly necessary to say that the giving way of the suture in these cases is due to the diseased condition of the bowel.

The obstruction caused by cancer is gradual, and a diagnosis is often not made for two or three months, when the obstruction becomes complete. The bowel has then become dilated and hypertrophied, the patient has been weakened by malnutrition and has become cachectic. When such an intestine is opened, its walls are œdematous and often three or four times the normal thickness, and the contents are especially septic. When this tissue is included in a stitch it rapidly shrinks, leaving the stitch loose and leaking. If the stitch holds at first the peristalsis may be violent, or sometimes we have complete atony, both conditions may prevent union. In

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<sup>1</sup> Read before the American Surgical Association, July, 1905

short, the whole situation is most unfavorable for the union of the cut ends, moreover, the relief of the obstruction is of more immediate importance than the removal of the disease.

Enterectomy with a temporary artificial anus was advocated by Reichel and urged by Treves in 1883. More recently, Mikulicz and others have operated in two sittings for malignant growths of the large intestine.

We have always believed that the mortality in these cases ought to be nearer 10 per cent than 50 per cent, and, having found every form of suture and mechanical appliance unreliable, have for several years now been doing these operations in two sittings, with most satisfactory results. Now that the technique has been improved, we think that enterectomy, with a temporary artificial anus, should be the operation of choice in all critical cases of intestinal obstruction where there is an opportunity for resection, whether it be in the large or the small intestine. Treves and others have objected to leaving a faecal fistula in the small intestine on account of the malnutrition caused by the loss of the undigested discharges from the upper bowel. I have overcome this difficulty in two cases (one here reported, the other in the *ANNALS OF SURGERY*, January, 1895), in which I resected a part of the small intestine, by collecting the discharge from the upper opening and injecting it into the lower opening. I have also improved the technique of the operation by stitching the open ends of the bowel together on the mesenteric side before they are fastened into the parietal wound. This greatly facilitates the closing of the artificial anus. We have never had a death from closing an artificial anus, though it has occasionally required more than one operation. It is a safe operation, and usually hardly disturbs the convalescence.

If the patient is in too critical a condition to risk primary resection, an artificial anus may be made in the distended bowel and the diseased portion resected at a later operation if an opportunity arises. This method is to be condemned except in cases of grave necessity, because at the second operation the peritoneal cavity is opened in the presence of a faecal fistula, also the disease, perhaps malignant, has been allowed

a longer time to develop, and it is always difficult to get such patients into good condition for a severe second operation. In using this method in an unfortunate case, at the second operation done one month after opening the bowel, we found the bowel for some distance from the malignant growth degenerated and friable, so that the stitches did not hold.

According to Hochenegg's method, the diseased intestine is freed and the mesenteric glands removed. The coil is then brought out of the abdomen and held in position by a fold of iodoform gauze passed through the mesentery. The abdominal wound is closed around the bowel. A few hours later he opens the distended intestine and inserts a glass tube. At the end of twelve days the diseased intestine is removed and the cut ends united and returned into the abdomen. This method is to be commended in that it effectually insures the peritoneum against contamination, but we can see no advantage in leaving the disease for twelve days in the outer wound. It seems equally safe to resect at once.

McGraw dissects the tumor free with the glands, then the two limbs of the intestine leading to and from the tumor are joined together by Lembert sutures, and an anastomosis made with an elastic ligature. The abdomen is then closed, leaving the anastomosis inside and the tumor protruding outside. The tumor is then cut away, and the afferent portion of the intestine is drained until the elastic ligature makes an anastomosis above the resection. This is certainly a most ingenious operation, but it is open to criticism, that its safety rests in the ability to prevent leaking about the elastic ligature and sutures placed in diseased intestinal wall, which is the same objection we are raising against resection with immediate suture.

The simplest method seems to us to be the best. Enucleate the tumor and remove the glands. When the tumor is free, draw the loop of intestine out through the abdominal wound. Wall off the peritoneal cavity with gauze. Clamp the lower efferent bowel and cut it off. Unite the mesenteric sides of the afferent and efferent bowel to facilitate the closing of the artificial anus. Stitch the upper and lower bowel to the peri-

toneal surface Close the wound about the ends of the intestines as much as possible, then clamp the upper distended bowel and cut away the tumor Pack the wound with gauze The clamp on the upper distended bowel can then be removed with certainty that the peritoneal cavity will not be infected by the fecal discharge, or, still better, if the symptoms are not urgent, the clamp may be left in place for several hours until the newly adjusted surfaces have been settled into place and have possibly begun to glue together, as in the first case here reported The important point is not to open the upper distended bowel until the peritoneal cavity is closed

In all these cases it is important to wash out the stomach before the operation and leave it empty, as there is great danger of regurgitation in the trachea under ether, due to handling the distended intestine

CASE I—*Cancerous Obstruction*—Patient was seen June 26, 1904, in consultation with Dr Baldwin, of Brookline A very robust man, thirty-five years old, apparently in perfect health, who had not been able to have a movement of the bowels for six days He had been constipated for the past six months, but had never seen blood or pus in the stools There was no pain or vomiting except from cathartics There was slight tenderness near the umbilicus No distention, no rise in temperature During the 26th, 27th, and 28th we tried opium, castor oil, calomel, and enemata without avail, little or no food being given Only about a quart of water could be forced into the rectum Operation, June 29 A median incision revealed a hard, puckering, annular growth constricting the sigmoid flexure The adjacent bowel was freed from its attachments, taking as much mesentery as possible, and raised into the abdominal wound No affected glands were found The peritoneal cavity was walled off with gauze, and a ligature placed around the bowel just below the growth The bowel was then cut above the ligature, and the lower (efferent) gut stitched into the lower part of the wound The growth, wrapped in gauze to avoid peritoneal contamination, was raised to facilitate further dissection The mesenteries of the efferent and afferent intestines being stitched together (to facilitate the later closing of the artificial anus) and the abdominal wound completely closed about the intestinal ends, a ligature was then put

around the distended afferent gut, the wound surface completely covered with gauze, and the tumor cut away. This ligature was not removed from the distended gut until several hours later, when the gauze dressing had become well glued to the entire wound surface. The patient was much relieved by the operation, and having no bad symptoms soon recovered his normal appetite. The gauze in the wound was constantly stained with feces, and was gradually cut away as fast as it loosened, leaving a bright granulating wound. Some of the last pieces of gauze removed from the region near the fecal fistula were seen to be white on the surface next to wound, showing that the fecal discharge had been effectually kept from the deeper part of wound surface by the gauze dressing.

The granulations were bright after the gauze was removed, and the wound healed rapidly. In September the open ends of the bowel had become perfectly united to the skin, no granulations remaining.

Dr Whitney, pathologist, reported as follows: "The specimen consisted of a piece of intestine about 6 centimetres in length, the greater part of which was occupied by a deeply ulcerated infiltrating new growth, leaving only a small margin of sound tissue at each end.

"Microscopic examination showed a new growth of irregular tubular glands infiltrating the entire thickness of the muscular coats at the central part and on the ends, with a growth into the submucous tissue only.

"*Diagnosis*—Adenocarcinoma."

Second operation, September 30. The ends of the gut were freed from the scar and united by an end-to-end anastomosis. Recovery was uneventful except for a small infarction which took place in the right lung on about the eighth day. The patient is now (more than a year after the operation) perfectly well and working as usual.

CASE II—*Gangrenous Intussusception*—The patient, a man thirty-eight years old, entered the accident room of the Massachusetts General Hospital on May 20, 1904. He had been perfectly well until two weeks before entrance, then he began to have ten or twelve movements of the bowels per day, with constant pain in the left side of abdomen. At times the pain would disappear for a few moments, only to reappear. Vomited considerably during this period and retained but little food, lost weight. Had not vomited blood or passed it per rectum.

The abdomen was moderately distended, and there was considerable muscular spasm. On the left side, running into the flank, an oval tumor was visible about on level of umbilicus, which seemed to move up and down with peristalsis. The tumor was firm but indentable, with an indefinite outline. Rectal examination negative.

May 21. Under free catharsis and enemata, the distended abdomen came down considerably. Stools not remarkable. Mass situated between umbilicus and tip of ninth rib on left side. When the large intestine was distended with water, the position of the mass was not changed. No gurgling through intestine or under the tumor. Intestinal peristalsis distinctly visible.

*Operation*—Six-inch incision through left rectus about on level with umbilicus revealed the colon much swollen, red, and oedematous, forming a sausage-shaped tumor of elastic consistency eight inches long. The colon was opened by a longitudinal cut, and a large gangrenous intussusception removed from the inside of the colon, the mesenteric vessels being tied inside the colon. As the opening into the upper colon where the intussusception had been cut away seemed too small, the cut ends of the gut were pulled apart and stitched into the parietal wound, the longitudinal opening in the descending colon having been closed with a running suture. A glass drainage-tube was tied into the proximal opening to carry away the fæces. The patient made a slow but uneventful recovery. The tube sloughed out in the second day and the bowel retracted into the wound.

The artificial anus was almost closed at an operation done three weeks after the first. A very small opening still remaining was closed by Dr. Scudder, who had charge of the wards at that time, a month later. The patient was in good health a year later.

Resection of a gangrenous intussusception with immediate suture is extremely dangerous, the mortality being about 85 per cent. Mikulicz has done a very ingenious operation for this condition. He first stitches the enlarged distended colon into the parietal wound, thus completely excluding the exposed colon from the peritoneal cavity. He then opens the anterior wall of the colon thus excluded, and removes the gangrenous intussusception thus exposed by cutting away the outer and inner layers of the intussusception and closing the cut edges by deep catgut sutures, so that the peritoneal cavity is not opened when it is



cut away. He then leaves the opening in the colon as an artificial anus, which is closed several weeks later.

Mikulicz has done two cases by this method with good results. So I think we have in Mikulicz's operation perhaps the best operation for the removal of a gangrenous intussusception. But when this operation is unadvisable, stitching the cut ends of intestine into the wound is the safest method.

*CASE III—Resection for Gangrene due to Thrombosis of the Mesenteric Artery*—The patient, a man twenty-two years old, entered the Massachusetts General Hospital, April 7, 1904, with the diagnosis of a duodenal or peptic ulcer. He had had gonorrhœa and syphilis, but no secondary symptoms. He had felt perfectly well until three weeks before entrance, when he began to have pain in epigastrium and vomiting. He had a good appetite, but vomited three or four times a day, the vomitus often had a "coffee-grounds" appearance, but he had never vomited fresh blood. He had lost eighteen pounds in weight.

While in the hospital his symptoms and distress increased, and he finally vomited some fresh blood.

*Operation*—On April 14, an anterior gastrojejunostomy was made with a bone bobbin. There was no evidence of disease of the stomach or pylorus. The stomach was not dilated. The small intestine was noted to be thin and friable when stitched and rather dark in color. The patient did well, and got early relief from the operation. He had a good appetite, retained and digested his food. On May 2 he complained of a pain in his abdomen, which soon passed away. May 3 he was seized with more severe abdominal cramp-like pain, with nausea and vomiting. The abdomen was soft, and a rounded mass was distinctly felt opposite the umbilicus on the left side. No result from the enemata. May 4 pain more severe, pulse, 120, abdomen swollen and tympanitic, so that tumor could scarcely be detected.

*Operation*—Incision in linea semilunaris, small amount of cloudy fluid. A coil of distended and almost black small intestine lay directly beneath incision, with neighboring coils slightly adhering to each other, and a little fibrin on them. The mesentery was black almost to its root. A careful examination showed no constricting band and no sign that the coil had been twisted. The coil was delivered while the peritoneal cavity was "walled off" with gauze, and fourteen inches found to be gangrenous with a foul odor. About an inch beyond the gangrenous area, on an

otherwise healthy part of the gut, was a small dark spot showing another centre of the same process. The affected coil was cut away between two clamps. No fæcal discharge was visible. The open ends of the intestine were now sutured to the parietal peritoneum, and the mesenteric borders were stitched together, thus keeping the ends together in order to facilitate a subsequent operation for closing the necessarily resulting artificial anus.

The patient made a prompt recovery. In a few days the skin became irritated by the acrid discharge from the artificial anus, and he began to show the want of proper nutrition. We judged from this that the excised coil must have been high up in the small intestine, a fact not accurately determined at the operation on account of the critical condition of the patient.

The skin around the artificial anus was protected with ointment and nutritious materials were injected into the open bowel, finally, we devised a system of collecting the partially digested material discharged from the upper bowel and injecting it into the lower end with a soft catheter. The patient was slightly inclined on one side, and the discharge was caught in a glass pus basin. The discharge was periodic and often quite thick. It was injected into the lower gut about five minutes after it came from the upper opening when the intestine became quiet. It was forced through a soft catheter with a hard rubber syringe. It had to be given very slowly to be retained, one-half ounce or so at a time, with brief intervals, until the whole discharge had been returned. In this way his nutrition was greatly improved.

The artificial anus was closed by Dr. Scudder on June 9, as my term of service had expired at that time. He was discharged July 14, having gained sixteen pounds, and is perfectly well to-day, more than a year after the operation.

The following is a quotation from the pathological report of Dr. G. H. Wright:

"It is of a black-red color, and at least twice as wide in diameter as normal, the peritoneal surface showing some fibrous thickening. On section the entire wall of the intestine is densely infiltrated with blackish, opaque, thick fluid. The same fluid is found in abundance in the lumen of the intestine. The mucous membrane in general is of a blackish, moist appearance, with no definite ulcerations. The portion of the mesentery adherent to the intestine is markedly infiltrated with black, thick fluid."

"Microscopic examination of pieces of the mesentery attached to the intestine show thrombosis of good-sized veins, but none of the arteries"

In this case I have not been able to understand why the thrombosis of the mesenteric vessels followed the operation of gastro-enterostomy, but I feel certain that the gangrene was due to the thrombosis

In the ANNALS OF SURGERY, January, 1895, I reported a case of resection of four feet of gangrenous intestine due to thrombosis of the mesenteric veins. In this case I stitched the open ends of the intestine into the wound as described above. This was the first successful case ever recorded of resection for gangrene due to mesenteric thrombosis. Since then, according to Jackson, Porter, and Quimby, who have collected all the cases up to 1904, there have been three other successful cases. They are as follows

GORDON. Resection of two feet of intestine and end-to-end suture over a bobbin. Intestine leaked into dressing five days after operation. Wound opened and packed, and in two days a slough came away, representing the entire suture line. Resulting fæcal fistula closed in two weeks. Recovery.

KOLBLING. Intestine resected and lower end of duodenum sewed up (because it was too short for anastomosis), and upper end of jejunum joined to stomach by anterior gastro-enterostomy. Much distention and vomiting followed with right parotitis, fever, and œdema, but patient finally recovered.

SPRENGEL. Ten centimetres of small intestine gangrenous, and was excised and ends left in the wound. Peritoneal cavity drained. Good convalescence. Fæcal fistula closed five weeks later with end-to-end suture. Recovery.

From this we see that five cases have recovered, one by Gordon, one by Kolbing, one by Sprengel, the other two done by myself, a mortality of 97 per cent according to Jackson, Porter, and Quimby. Of these, three uninterrupted recoveries were operated on in two sittings, the resected ends being left open at the first operation, while Gordon's case, where end-to-end suture was used, only recovered after the sloughing out of the entire suture line. This leaves Kolbing's case the

only one in which immediate suture has acted even fairly well. We think it is therefore evident that resection in two sittings has so far proved the most satisfactory method in resections of gangrenous intestine due to thrombosis of the mesenteric artery.

*Summary* —1 We find the prevalent method of enterectomy with immediate suture in cases of intestinal obstruction attended with a high mortality due to the changed condition of the distended bowel.

2 Enterostomy with later enterectomy is to be reserved for the cases unable to bear primary enterectomy.

3 Enterectomy with a temporary artificial anus should be the operation of choice in all critical cases of intestinal obstruction, where there is an opportunity for resection, whether it involves the large or the small intestine.

4 The suggested improvements in the technique are as follows.

The upper distended bowel should not be opened until the peritoneal cavity is completely closed. (This is already the practice of several surgeons.)

The open ends of the bowel should be stitched together on their mesenteric side before they are fastened into the parietal wound. This will greatly facilitate the later closing of the artificial anus.

When the artificial anus is in the small intestine, the partially digested discharge from the upper opening should be collected and injected into the efferent opening.

5 The closing of the artificial anus is a safe operation, and hardly disturbs the convalescence.

6 Up to the present time not enough cases have been done by this method to estimate its relative mortality, but the cases here reported, with those referred to, suggest the probability of better results than have been obtained by enterectomy with immediate suture.

## ANGULATION AT THE SIGMOID

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ANGULATION of the intestinal canal at the sigmoid is a pathological condition which we believe exists, but has not been described. The chief symptom of this condition is intestinal obstruction, and those of advanced years seem to be most liable to be affected.

By angulation *at* the sigmoid, we mean that the intestine is so bent upon itself, at either the upper or lower end of the sigmoid, that complete or partial obstruction to the passage of the faecal current is established.

The sigmoid is firmly attached at both its proximal and distal ends, the descending colon above is quite freely movable, and the sigmoid itself is loosely attached. This permits the portion of bowel immediately above the point of firm attachment to drop down, and so draw on the firmly attached portion that an angulation results.

That this condition does actually occur, we believe is proven by the post-mortem recorded in our series of cases. These cases so closely resemble cases of volvulus that it is only natural that the question of diagnosis should be raised. Are not the cases here presented cases of volvulus? We believe not, for it seems hardly possible that a twisting of the mesentery, such as would necessarily accompany volvulus, could exist for so long a period as three weeks without causing either gangrene of the gut or a profuse exudation of serum in the peritoneal cavity. Neither of these existed in our cases.

Cases which have been diagnosed as volvulus may in many instances, we believe, really have been cases of angulation, for in not all is the condition actually seen. An operator makes the diagnosis of volvulus, opens the abdomen, and during the

manipulations, while approaching the suspected seat of trouble, hears a sudden gurgle and the intestinal contents pass on. Naturally, he feels he has released the twisted coil and that the diagnosis is confirmed. Would it not be more reasonable to believe that an angulation would so be overcome than that a twist would be undone?

Dr Emil Reis (*ANNALS OF SURGERY*, October, 1904), in a very interesting article entitled "Mesosigmoiditis, and Its Relation to Recurrent Volvulus of the Sigmoid Flexure," relates the history of a case, and describes the conditions found during the operation. He says

"The sigmoid was not twisted when the abdomen was opened, but a slight impulse given to the upper half of it sufficed to make it drop upon the lower half." From this description we can see no direct evidence in this case, the anatomical condition described was nearer an angulation, although by manipulation it could be converted into a volvulus.

Angulation at the sigmoid may occur at either its proximal or distal end, as these points are comparatively fixed by a short mesentery. In the one case the sigmoid is empty, as shown by the autopsy, to be recorded, and in the cases where the angulation is at the lower end the sigmoid is dilated. This was probably the condition in Case I, although before operation the symptoms and examination pointed to a probable intussusception. That this was not the cause was shown at the operation.

CASE I—Mrs B, aged forty-nine years, was admitted to the Methodist Episcopal Hospital in the service of Dr George R. Fowler, with the following history. Patient had been a healthy woman, family history negative, four days ago, without apparent cause, she began to feel a discomfort in the abdomen, associated with constipation. While stooping forward she had a sharp pain in the middle of the back and lumbar region. Patient was given cathartics and enemata. The latter at first brought away a few small particles of fecal matter. Meteorism progressed until the belly became greatly distended. During twenty-four hours before admission, vomiting appeared, but was not stercoraceous. There

had been a good deal of abdominal pain Rectal examination revealed high up in the rectum a ridge, which was taken to be the end of an intussuscepted intestine No tumor could be made out

Operation through a median incision failed to disclose any tumor mass The entire intestinal tract was greatly distended, the cæcum reaching nearly the median line The median wound was closed, a second incision made in the right inguinal region, and the cæcum lifted into it was there sutured so as to produce an artificial anus There was some discharge of fæces and gas immediately, but not any great quantity for thirty-six hours The next morning, after the free discharge from the artificial anus, there was a free normal rectal movement After this very large amounts were passed per rectum The case progressed favorably, and on October 23 the artificial anus was closed The patient made a good recovery On account of the general laxity of the abdominal wall, patient was advised to continuously wear an abdominal bandage This she did not do

After her discharge from the hospital, she went about her work, and for some time suffered no discomfort, but later a ventral hernia developed at the site of the artificial anus I saw her on several occasions when signs of strangulation were present, but was able to reduce the mass On one occasion, three years later, this became strangulated and irreducible, and operation was undertaken The intestines were firmly matted together in the sac, and it was with great difficulty that the mass was reduced and the operation completed At the time, examination failed to reveal anything in the abdomen to account for the previous obstruction

CASE II —This case was presented in the person of Mrs H, sixty-two years old, who was seen in consultation with the late Dr Bowser The history was of complete obstipation for three weeks For a number of years she suffered with constipation, and for this continually took cathartics During the three weeks no movement was obtained from the use of frequently repeated enemata and the administration of cathartics During this time there had been a very general increase in distention and no vomiting until the day of examination On examination we found a greatly distended abdomen, especially in the lateral parts The patient was very weak and pulse feeble and rapid, no tenderness

over the abdomen, and at no point could a tumor or sense of resistance be felt. She was removed to St John's Hospital, and under cocaine anæsthesia a right lateral colostomy done, using the cæcum, which was greatly distended. The bowel was brought through the muscle and sutured, by a number of silk sutures, to the skin. An immediate opening was effected, this gave rise to a profuse discharge of liquid fæces, which continued almost without interruption for two days. At the end of eight hours, much to our surprise, she had a normal evacuation of the bowels. From this time on, at irregular intervals, the discharges from the artificial anus were supplemented by normal bowel movements. She made a good recovery and went to her home. Nothing was heard from her until February, 1899, when she came complaining of a prolapse of the bowel at the artificial anus. This could easily be reduced. Operation for the closure of the opening was advised and refused. On the morning of May 19 following, I was summoned to her home, and found that the prolapse had recurred and that it could not be reduced. The cæcum had herniated through the opening made in it for the artificial anus, and in the parts projecting, the openings of the appendix and ileocæcal valve could be plainly seen, in fact, it was an intussusception passing out through the artificial anus. The parts had become so swollen and œdematous that reduction was impossible. Operation was now consented to, and she was removed to the Norwegian Hospital and the following operation performed. An elliptical incision was made about the opening, including about a half-inch of normal skin. This was carried through the muscle and peritoneum, and the mass entirely freed and lifted out of the abdomen. The opening in the cæcum was then enlarged so that the mass could be easily reduced. After reduction, the rent in the side of the cæcum, being the opening made for the artificial anus, was closed by silk sutures. The abdomen was then thoroughly explored for the cause of the original obstruction, and no tumor, adhesions, or band of any kind could be found. The external wound was completely closed. Healing was per primam, and a complete recovery followed, the patient continuing to have normal bowel movements.

These cases caused me to reflect on the probable cause of the obstruction, and we advanced the theory that with the advance of age and general relaxation of tissue the sigmoid



became more movable than normal, that the continued use of saline and other cathartics further relaxed the tissues and increased the amount of fluid discharge in the sigmoid. The intestine, borne down by its own weight, fell into the true pelvis and, dragging on the fixed upper end of the rectum, produced an angulation at that point. Now, as further efforts to move the bowels produced increased peristalsis from above, this angulation would only become more acute and complete. Rectal enemata failed to pass the point and only the injected fluid would return. In both cases rectal examination had failed to discover any mass, but in the upper pelvis could be felt the downward pressure of distended intestine.

This was only a theory and could not be verified.

CASE III—In the fall of 1902, I saw, in consultation with Dr Frank W. Shaw, a lady, seventy years of age, a constant user of saline and other cathartics for many years, who suddenly developed obstructive symptoms. She became much distended, no fever, pulse quite feeble and rapid, some nausea after the fourth day and pain at intervals, very sharp and acute, apparently from peristalsis due to castor oil, which had been freely administered. Enemata had been given with no result. The question of probable carcinoma was raised and operation considered. Having in mind the two cases above mentioned, I advised high elevation of the hips and repetition of the water enemata. This with the hope that, if the theory were correct, the distended sigmoid would be displaced by gravity from the pelvis, and that the water in the rectum would assist in overcoming the angulation. After about six hours our efforts were rewarded by a free movement from the bowel. During the next twenty-four hours the amount of fluid faecal matter passed was astonishing. This continued for three days. The patient made a good recovery, and has had no recurrence of the trouble.

This case resembled the other two in the previous history and large discharges after the obstruction was overcome, and the result seemed to justify the diagnosis.

During the past year we believe the diagnosis has been substantiated by autopsy.

CASE IV —Through the kindness of Dr Archibald Murray, I am enabled to report the following case. Man, aged about seventy years, was ill with pneumonia when he developed symptoms of intestinal obstruction with fæcal vomiting. His condition from the pneumonia was so grave that operation could not be considered. At autopsy the large and small intestine were found greatly distended with fluid fæcal matter, the amount of fluid in the intestines being enormous. The descending colon, by the weight of the fluid contained, had been dragged towards the pelvis and angulated the gut at the juncture of colon and sigmoid. There was no twist or band to obstruct, it was the direct result of traction against a fixed point. The rectum and sigmoid were empty.

CASE V —In April, 1905, a man, fifty-five years of age, was admitted to my service in the Long Island College Hospital. He gave the following history. For a number of months he had suffered from recurrent attacks of obstinate constipation, which when relieved were followed for several days by profuse fæcal discharges. He was not very intelligent, and an accurate history could not be obtained. For two weeks previous to admission he had had no movement of the bowels, appetite was lost, and flesh and strength were very much reduced. The abdomen was somewhat distended, careful examination revealed no point of tenderness and no tumor. Rectal examination revealed an empty bowel, and at about four inches above the sphincter an obstruction. To the touch this gave the impression that a stout band was drawn across the bowel at that point. The finger on removal showed no trace of blood, mucus, or fæcal matter.

Exploratory operation was performed before a class of about fifty students from the college, together with the family physician and my assistants. A diagnosis of carcinoma of the sigmoid had been made, based principally on the loss of flesh. On opening the abdomen the small intestine was found to be only partially distended, but the large intestine to the left iliac fossa was greatly dilated.

Examination failed to disclose the mass we were looking for, but did show very plainly that the cause of the obstruction was an angulation at the lower end of the sigmoid. Tracing the bowel downward from the colon it passed deeply into the pelvis

and then rose again to the point of attachment of the intestine near the ileosacral joint. At this point there was a distinct bending of the bowel upon itself, so that a complete obstruction was created, and the intestine beyond was entirely empty. This was satisfactorily demonstrated to all present.

On lifting the sigmoid from the true pelvis the contents of the gut immediately passed into the rectum. At the point of obstruction there was no band or adhesion of any sort. In the folds of the mesosigmoid, which was very long, were a number of recent adhesions. These were easily broken down. The intestine was held well out of the pelvis by my assistant, Dr W B Brinsmade, while I sutured the external surface of the mesosigmoid to the parietal peritoneum covering the iliacs, by several layers of catgut sutures. The abdomen was closed. The next day a normal movement of the bowels occurred, and from then until his discharge from the hospital there was no more trouble. Valescence was retarded by a sharp attack of pneumonia which developed on the second day and ran a course of seven days. He was discharged at the end of the third week much improved in general condition and with the constipation entirely overcome.

In this case we had presented a typical case of angulation which was easily and satisfactorily demonstrated to a large number of spectators.

Two other cases of obstruction, which seem to belong to this class, treated by artificial anus and given complete relief followed by natural movements of the bowel, have come under the writer's observation, but could not be followed to ultimate cure.

These cases resemble very closely cases of new growth in the large intestine, volvulus at the sigmoid, and also cases of mesosigmoiditis as described by Ries. How shall we differentiate them? In cases of carcinoma, we have the previous history of constipation and general loss of flesh and strength, with often the sudden onset of obstructive symptoms. Carcinoma of the large intestine is most apt to occur in the upper or middle segments of the rectum, by rectal examination the mass can be felt, and the withdrawal of the finger is followed by the escape of mucus and blood. In other cases the growth

is at either of the flexures of the colon, and can usually be felt or the distended intestine cannot be traced to the sigmoid

Cases of volvulus of the sigmoid naturally give about the same symptoms and, unless very marked, would probably give way to the same treatment as indicated in cases of angulation. Where volvulus is a symptom of mesosigmoiditis, we have usually a history of repeated attacks of obstruction, and of inflammatory symptoms antedating these attacks. These patients usually suffer with backache, referred to the coccyx, or pain across the lower part of the abdomen, possibly discharges of pus and mucus from the rectum, and on rectal examination may show a diffuse infiltration of the paraproctic tissue.

In cases of angulation of the sigmoid, there can be felt by rectal examination nothing but the pressure of distended intestine above the pelvis. The rectum is empty, usually not dilated, and the withdrawal of the finger is not followed by any discharge whatever. These patients usually show no loss of flesh nor change in their general health. The symptoms sometimes come on slowly, as in Case II, or suddenly, as in Case III.

*Treatment*—The use of cathartics is to be advised against until some evidence of faecal matter in the stools is present, then the use of castor oil would seem to be the least objectionable. If the patient's condition will permit, rectal injections, with the patient practically in the knee-chest position, may be tried, and in some cases will be effective. If this fail after a few attempts, or the patient's condition is poor, operation for the production of an artificial anus, using the caecum, is to be done. This may be performed under either local or general anaesthesia. The bowel should be immediately opened. After two or three months, if normal rectal movements have been established, the artificial opening may easily be closed.

A somewhat similar condition is described by Walzberg (*Arch f klin Chir*, Band lxxvi) as occurring in the upper intestine after operations. He describes it as acute duodeno-jejunal intestinal obstruction. Cases following operation will

sometimes pursue a normal course, except for the continuation of vomiting for several days, or this may not occur for two or three days, when it will appear and continue, and be followed by profound prostration. Examination will reveal the area over the stomach markedly distended, the outline of the organ being visible. There is usually little or no nausea, the vomiting of large quantities of fluid occurs at long intervals and contains more or less bile. From a clear greenish color at first, it soon becomes darker until it becomes a dark brown. Autopsy in such a case showed no peritonitis. The stomach and duodenum were greatly distended and the remainder of the intestine empty, but displaced downward into the pelvis. On raising the omentum and transverse colon, the duodenum was found greatly distended above the point where it passes under the parietal attachment of the mesentery. The base of the mesentery crossed over in front of the gut in the form of a three-inch band, and was firmly held in this position by the displaced intestines. The mechanism of this condition is explained by a primary dilatation of the stomach, the atonic intestines are pressed downward, the mesentery dragged upon, and the duodenum is pinched between it and the vertebræ. These cases are best treated, according to Mayo-Robson, by frequent lavage, and if the symptoms do not subside, the patient should have the pelvis well elevated, or the patient turned on the side. In some cases the supine position may give relief. Morphine is of service, and in my hands has, I believe, saved several cases. The use of cathartics only tends to increase the pressure from above and make the condition worse.

I mention this condition with the one we have been discussing because I believe the mechanical conditions are similar, and the treatment in each case must be directed to relief of the pressure from above, and not attempt to force the contents of the upper bowel downward by cathartics.

## MESOCOLIC HERNIA.

BY JOSEPH FAULKNER DOBSON, M S (LOND ),  
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THE body from which the specimen of this rare variety of retroperitoneal hernia was obtained was that of a still-born hydrocephalic foetus a few months short of full term. It was hardened by injecting the thoracic aorta with a 25 per cent solution of formalin.

On opening the abdomen, turning aside the small intestines and raising the transverse colon, a hernial sac containing jejunum was brought into view.

The sac lies to the left of the duodenojejunal flexure, extending between the layers of the transverse mesocolon to the splenic flexure. The layer of peritoneum forming the posterior wall of the sac is in contact with the left kidney and suprarenal capsule, and the tail of the pancreas, while showing through the mesocolon forming the upper limit of the sac, is the greater curvature of the stomach.

In the free border of the sac can be seen the ascending branch of the left colic artery. The orifice of the sac extends quite up to the transverse colon, the artery runs in the free edge of the peritoneal fold forming the anterior wall of the sac, and does not pass into the mesocolon until it approaches close to the bowel. The mouth of the hernial sac, which looks forward and to the right, measures in length 2 centimetres, in breadth 1.5 centimetres, while the depth of the sac is 2 centimetres.

The hernia contains portions of two coils of intestine, formed by the first loops of the jejunum, which enters into the sac, passes out, then re-enters and passes out again.

Both the superior and the inferior duodenal folds and fossæ are present, and the inferior mesenteric vein can be seen lying under the posterior parietal peritoneum at some little distance from the orifice of the sac.

With the exception of the hydrocephalus, the body presented no other abnormality.

The variety of retroperitoneal hernia described above appears to be extremely rare, indeed, so rare that its very existence is unmentioned either by Treves or by Moynihan

The former, in his Hunterian Lectures<sup>1</sup> and in his work on "Intestinal Obstruction,"<sup>2</sup> states that all retroperitoneal herniæ arising in the neighborhood of the duodenum have their origin in the fossa duodenojejunalis of Treitz (inferior duodenal fossa, Jonnesco, Moynihan)

This fossa exists in a very large proportion of bodies It is bounded in front by the inferior duodenal fold, this peritoneal fold, triangular in shape, runs from the anterior surface of the ascending limb of the duodenum to blend with the peritoneum covering the posterior abdominal wall, it is best seen by lifting aside the small intestines and gently drawing the duodenum to the right The fossa is bounded in front by the inferior duodenal fold, to the right by the duodenum, and behind by the peritoneum covering the lumbar vertebræ, its orifice looks upward

Sir F Treves describes the hernial sac as extending in front of the kidney and pancreas and being more or less surrounded by the transverse and descending colon "The vessels have the following relation to the anterior or free margin of the orifice, curving round the upper part of the border is the inferior mesenteric vein, in relation to the vein is the ascending branch of the left colic artery with its vein, the thickness and roundness of the free border are due to the large inferior mesenteric vein which it contains"<sup>3</sup>

In this account of the mode of origin of these herniæ, Sir F Treves follows the description originally given by Treitz

Of late years, the tendency to regard the inferior duodenal fossa as the seat of origin of all varieties of duodenal hernia has diminished

Mr Moynihan<sup>4</sup> divides herniæ arising in the neighborhood of the duodenum into two varieties left duodenal hernia, of which the orifice looks to the right and the fundus of the sac to the left, and right duodenal hernia, with the orifice to the left and the fundus to the right We may, in this place, confine our attention to left duodenal hernia





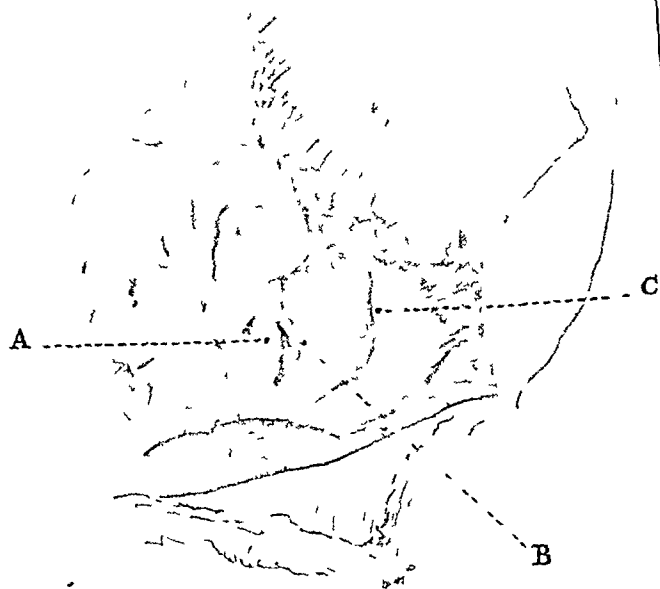


FIG 1—Drawing of hernia after removal of coils of jejunum from the interior of the sac A, ascending portion of the duodenum B inferior mesenteric vein C, free margin of sac containing the ascending branch of the left colic artery (I am much indebted to Mr M A Teale for this drawing of the specimen )

These, Mr Moynihan considers, have their origin in the paraduodenal fossa or fossa of Landzert. He describes the fossa as follows

"It is situated to the left and some distance from the ascending limb of the duodenum. The fossa is caused by the raising up of a fold—the plica venosa—by the inferior mesenteric vein, the plica venosa consists of a vertical and a horizontal portion, the vertical being to the left of and below the fossa, and the horizontal bounding the fossa above" <sup>5</sup>

Mr Moynihan states that "the orifice of a [left duodenal] hernial sac is always vascular. In the neck of such a sac can always be seen the inferior mesenteric vein, the left colic artery may be closely applied to it, or may be some little distance away, the fold containing the vein is the plica venosa, and the fossa bounded by such fold is the paraduodenal fossa, or fossa of Landzert" <sup>6</sup>

Jonnesco <sup>7</sup> describes a fossa to which he gives the name "paraduodenal fossa," formed by a fold containing the ascending branch of the left colic artery. This semilunar fold forms the anterior boundary of the fossa, which extends to the left between the layers of the transverse mesocolon towards the splenic flexure. In Jonnesco's drawing of this fossa, the inferior mesenteric vein is depicted running under the posterior parietal peritoneum, and raising up a subsidiary fold dividing the fossa into an upper and a lower portion.

I have lately seen in a dissecting-room body a fossa similar to the one described and depicted by Jonnesco. On the under surface of the transverse mesocolon was a fold containing the ascending branch of the left colic artery, and this fold of peritoneum formed the anterior boundary of a fossa into which it was possible to insert a small coil of intestine. The value of this observation is, however, entirely negatived by the fact that there were numerous adhesions around the appendix, and in other parts of the abdominal cavity, particularly in the neighborhood of the splenic flexure and descending colon, under such circumstances it is impossible to say whether the fold was a congenital one or not.

It is preferable to restrict the term "paraduodenal fossa" to the cavity bounded by the fold containing the inferior mesenteric vein,—the fossa of Landzert.

The fossa described by Jonnesco has not been generally accepted by anatomists, but it seems that the specimen which I have described above is an example of a hernia into this fossa

It is quite certain that this hernia did not have its origin in the inferior duodenal fossa (duodenojejunalis of Treitz), as this fossa can be observed intact in the same specimen. It is also equally certain that it did not arise in the paraduodenal fossa of Landzert, as the inferior mesenteric vein, which runs in the fold forming the margin of the fossa of Landzert, is not included in the margin of the opening into this hernial sac, but can be seen running behind the parietal peritoneum at some little distance from the orifice. We must therefore regard this hernia as belonging to a distinct and definite variety, not to be confounded with the usual form of left duodenal hernia.

The hernia which Astley Cooper<sup>8</sup> described and figured under the heading of "mesocolic hernia" may be an example of this variety. In the description and in the accompanying plate no mention is made of the inferior mesenteric vein, while the position of the ascending branch of the left colic artery—running in the free margin of the orifice of the sac—is clearly shown.

Had this mesocolic hernia of Astley Cooper's been an example of the ordinary form of left duodenal hernia, surely that distinguished surgeon and anatomist would not have failed to note the important position of the inferior mesenteric vein in the neck of the hernial sac.

No doubt other specimens of this variety of retroperitoneal hernia have been seen, but, so far as I have observed, in none has the exact relation of the colica-sinistra artery and the inferior mesenteric vein to the neck of the sac been described, and in none has a clear distinction been drawn between the variety under consideration and the ordinary forms of left duodenal hernia.

It is to be hoped that the origin and frequency of these herniæ may be definitely settled by the publication of all cases

observed, with especial reference to the exact relations of the colica-sinistra artery and the inferior mesenteric vein to the neck of the hernial sac

## REFERENCES

- <sup>1</sup>Treves Hunterian Lectures, 1885
- <sup>2</sup>Treves Intestinal Obstruction, 1899
- <sup>3</sup>Ibid, p 112
- <sup>4</sup>Moynihan Retroperitoneal Hernia, 1899, page 42
- <sup>5</sup>Ibid, page 34
- <sup>6</sup>Ibid, page 45
- <sup>7</sup>Jonnesco, in Poirier's Traite d'Anatomie Humaine, vol 1v, page 260
- <sup>8</sup>Astley Cooper Crural and Umbilical Hernia, Part II, 1807

# LYMPHATIC AND HEPATIC INFECTIONS SECONDARY TO APPENDICITIS <sup>1</sup>

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IN considering the lymphatic and hepatic infections secondary to appendicitis, I shall not attempt to enter into the innumerable questions and problems that belong to so large a subject. But I will rather refer, in a somewhat desultory way, to the few points that have come within my own experience, in the hope that it may reawaken interest in so obscure a subject, especially on the part of the general practitioner.

Whatever views are offered here are based on a pretty general review of the literature and on a personal experience of thirty-nine cases,<sup>\*</sup> all except two of which have been identified at operation or autopsy or both.

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<sup>1</sup> Read before the Chicago Surgical Society, April, 1905.

\* Since reading this paper, we have had two additional cases of subphrenic abscess at the Carney Hospital, both of which were fatal. The first case was in a girl of eighteen, who was operated upon within twenty-four hours from the beginning of an attack of acute appendicitis. The gangrenous appendix was removed and the wound was drained. There was no infection of the peritoneum beyond the immediate region of the appendix which lay posterior to the cæcum. The mesenterium contained thrombi and was removed. For a few days the condition was satisfactory, when the pulse and temperature began to rise, and there was slight icterus, with definite hepatic tenderness. Exploration of the sinus showed a small abscess, posterior to the peritoneum, at the original site of the appendix. Improvement followed drainage for a week, when the symptoms of sepsis again appeared, and three weeks from the first operation a pelvic abscess, not connected with the first wound, was opened and drained. In spite of free drainage, the patient did not improve, but began to show evidence of trouble in the upper abdomen. With more definite signs as a guide, the abdomen was opened through an epigastric incision five weeks from the time of onset and a foul subphrenic abscess to the left of the median line was drained. The patient did not improve, however, but steadily became more and more septic until death three weeks later.

The second case occurred in a man thirty-seven years old, who was brought to the hospital five weeks from the beginning of an attack of appendicitis. A large subphrenic abscess over the right lobe was opened and drained through the chest wall after excision of the eighth and ninth ribs. Very little improvement resulted, and he died on the sixth day with high pulse and temperature.

With regard to these infections, I shall limit myself to the lymphatic area of the right side of the body extending upward from the cæcal to the costal region. Within this small space of the body, together with that occupied by the liver, a good share of the gravest secondary complications incident to appendiceal infection takes place.

Chvostek has given a most clear and complete exposition of the diseases of the portal system, with an extensive bibliography up to 1882. I have used his general conclusions in addition to those of Perutz, Berthelin, Gruneisen, and Abbadie, who have brought the literature more or less completely up to date. Inasmuch, however, as I find that there are certain points on which my conclusions are more or less at variance with those expressed by the authors mentioned, it has seemed to me wise to review in the original a large majority of the references, cited since the publication of Chvostek's paper. Altogether in the last few years there are something over 200 references, and it is needless to list them all. In the above-mentioned theses a fair aggregate may be found, to which additional references, mainly of isolated cases, may be added from the *Index Medicus*.

Broadly speaking, very little as regards infections through the portal system can be added to Chvostek's exposition. Those interested are referred to the original article in the *Wiener Klinik* for 1882.

To enter into the origin of liver abscesses of all types is a great temptation, but it would lead us too far from the class which I have chosen for discussion. In discussing the general subject once for all, suffice it for us to mention, as worthy of our consideration in a differential diagnosis, the following possible causes of a liver abscess: trauma, foreign bodies (including worms), dysentery, malaria, amœbæ, infections of the thoracic organs and of the umbilicus, pyæmia arising from various infections in any portion of the body, anthrax, ulcers of the gastro-intestinal tract, pelvic infections, splenic abscess, abscess of the mesenteric lymph-nodes, infections of the biliary tracts and pancreas, from peritonitis, echinococcus, infection after hæmorrhoidal operation, etc.

Much has been written about tropical abscess, and the general course and treatment are now well established. The infections incident to many of the conditions enumerated above are of secondary importance compared to that of the original disease. But when we come to infection following appendicitis, we are at once struck with a reversal of the condition, for we must appreciate that it is the milder, so-called latent, forms of appendiceal inflammation that may start the grave hepatic infections. It is on account of this very disproportion that I have been influenced to emphasize the importance of this subject once again.

In 1900 and again in 1902 I briefly reported a few cases that came under my observation, but the association of appendicitis with lymphatic and hepatic infections is still overlooked by those of large experience, and it is only by constant reiteration that a subject of this importance can be brought up to its true level.

In the present paper I shall not hesitate to make use of my earlier cases to illustrate certain data, even at the risk of making my own experiences unduly prominent. At the same time I shall not enumerate all of the cases that I have seen, because several of them are merely typical and do not illustrate any particular point.

The thirty-nine cases which I have observed may be divided as follows: undoubted portal infections, 15, subphrenic and portal infections, 2, probable portal infection, 1, abscess of the liver in which the pathway of infection could not be determined, 2, subphrenic abscesses, 5, retroperitoneal lymphangitis, 14.

Subphrenic abscess, as a lesion classed by itself, has been so thoroughly elucidated by Gruneisen and others that it need not be treated in detail here. Infection of the subphrenic space from an appendicitis may take place through the lymphatics, through the direct invasion of pus travelling along the posterior cellular spaces, through direct invasion from the peritoneal cavity (as shown in the autopsy of Case No. 7 reported by Christian and Lehr in the *Boston City*

*Hospital Reports* for 1902), or from extension of a pre-existing liver abscess. Infection may, on the other hand, travel from the subphrenic space to the liver, forming secondary abscesses in that organ.

The abscesses coming by the extraperitoneal route, according to Sachs, can never take up the whole dome of the diaphragm. The adhesion of the peritoneum to the diaphragm is so firm that the infections appear more as phlegmons, breaking through and forming collections of pus between the liver and the diaphragm. Subphrenic abscesses may also be the remains of a general abdominal infection, the contents varying with the infection. The type of appendicitis prone to produce these abscesses, however, is that which invades the retroperitoneal tissue of the cæcal region (Gruneisen).

Sanger, injecting a solution behind the colon, found that it always passed over the right kidney and formed a large lake, at the level of the horizontal portion of the duodenum it ascended past the round edge of the liver to the diaphragm. Abscesses need not necessarily form in this pathway between the infected appendix and the terminal abscess at the diaphragm.

Bourkhardt considers that the two commoner methods of infection are (1) by the retroperitoneal tissue, and (2) by direct invasion. Gruneisen reports two left- as against twenty-seven right-sided abscesses, the former being the remains of a general purulent peritonitis, hence the probability is that a left-sided subphrenic abscess is of intraperitoneal origin. An example is seen in Christian and Lehr's case mentioned above. This occurred in a boy of eleven, who showed at autopsy general adhesion of the intestines, while just under the diaphragm on the left was a large abscess cavity located outside the stomach and partially walled off by the liver, containing greenish-yellow pus. A channel could be traced from this abscess to the ileocæcal region with numerous side channels. The abscess was not retroperitoneal.

Eisendrath has reported a case in which, having first simply opened and drained an appendix abscess, he was obliged



a few days later to reopen the abdomen for a recurrence of the symptoms, at the second operation the appendix was removed. In spite of this, sepsis continued, and nearly three weeks later, he drained an abscess situated between the spleen, left lobe of the liver, and below the diaphragm. Death followed two weeks later. No autopsy was allowed. Although this abscess undoubtedly originated in the appendix as a primary cause, it is not clear that it may not have come by direct extension from a second intra-abdominal abscess in the left upper quadrant.

Sooner or later, in a large proportion of cases, infection of the pleura in some form is sure to be found. Subphrenic abscesses are more likely to break spontaneously into the pleural cavity or along the pleural adhesions into the lung rather than downward into the abdomen. Metastases in the kidney, brain, lungs, etc., may take place and be important as causes of death (Gruneisen).

In exceptional cases of high appendix abscesses, the infection may creep along the colon to the anterior edge of the liver, whence it spreads to the subphrenic space. Gruneisen reports an autopsy in which a solidly walled canal passed close to and in front of the ascending colon up to the liver. It then extended to the anterior surface of the kidney along its upper end, and to the posterior edge of the liver.

Maydl has observed that extraperitoneal abscesses perforate more freely into the chest cavity than do the intraperitoneal type, but that in the latter exudation into the pleura is more frequent.

Gruneisen recognizes that hepatic abscesses may serve as the origin of subphrenic abscesses.

That infection of the lymphatic channels should take place with great frequency in inflammation of the appendix need cause no surprise, when we consider that that organ and the adjacent walls of the cæcum are peculiarly rich in lymphoid tissue. Clinically, we see, almost universally, some evidence of absorption in the mesenteric lymph-nodes. This is notably evident in children, and it frequently happens that

a bunch or string of tender lymph-nodes is much more in evidence on palpation of the unopened abdomen than the appendix itself, in which, indeed, the gross infective process may have subsided. An analogous condition is seen in the cervical lymph-nodes during and subsequent to microbic invasions of the pharyngeal group of lymphatic organs. It is on a similar basis that we should look for more frequent evidences of lymphatic invasions along the retroperitoneal lumbar chain of lymphatics, presupposing that there is a liberal communication between the lymphatics of the cæco-appendix walls and this lymphatic chain.

Lockwood, in 1900, went so far as to state that this retroperitoneal chain was the main route of the current from the appendix and cæcum, but Poirier and Cunéo scout this idea as "absolutely visionary," maintaining that the normal terminations are the glands of the ileocæcal group, communication taking place to some extent, however, with the neighboring groups directly or indirectly.

Berthelin believes that the lymphatics play only a slight rôle as a means of conduction to the liver, and in support of this calls attention to the absence of connection between the lymphatic system of the cæcum and the liver, he maintains that such an infection can only be through the intermediary of the peritoneal lymphatics, perihepatitis being one of the first manifestations. Jones likewise puts little stress on the infection of the liver through the lymphatics, either intra- or extraperitoneal.

However, lymphatic paths do extend along the retroperitoneal space to the liver, diaphragm, and thoracic regions, and, in addition, there is a communication between the lymphatics of the diaphragm and those of the peritoneum, while, as the well-known experiments of Clarke and others show, direct absorption of infection may take place from the general abdominal cavity into the diaphragmatic lymphatics. If to these paths we add the mechanical portage of pus and its germs from abscesses in the peritoneal cavity pressing directly upon the liver substance, we have still another manner of origin of hepatic abscess secondary to an appendicitis.

Infection does not necessarily produce abscesses at its point of origin here any more than in other lymphatic tracts in the body. The abscess formation may take place at some higher point, like the peritoneal space of the subdiaphragmatic region. Thus a subphrenic abscess starting undoubtedly from the cæcal region may display no trace of abscess in any part of its course (Gruneisen).

Battle and Corner realize that while infection by the lymphatics must be common, considering the septic nature of appendicitis, yet it is often not recognized. They, too, have encountered retroperitoneal abscesses supposed to be of glandular origin, the primary source in the appendix not being recognized.

Fowler, who terms this retroperitoneal infection a "lumbar phlegmon," states that "a history of an attack of appendicitis may be absent, and yet the infection has its origin in the appendix." This is less true now than a few years ago, because surgeons at least are recognizing with greater accuracy the typical symptoms of mild and transient appendicitis that are overlooked or underestimated by the observer of small experience.

Furthermore, in analyzing the earlier reports of cases, one who reads between the lines can hardly fail to recognize mild or subacute appendicitis from the signs that failed of interpretation at the time.

Infection by way of the arteries is one of the manifestations of a general pyæmic process, and it may be dismissed here without further consideration. So, too, with infection from or by the bile passages.

Typhoid ulcerations and tuberculous ulcerations are rarely the source of hepatic infection.

Semmola and Geoffredi state that tuberculous ulcerations are never the cause of suppurative hepatitis because they cause obliteration of the veins, and we can recall no case reported where there was a definite relation established between such an intestinal lesion and an hepatic infection. Cases from puerperal infection are rare, but the possibility must be considered.

One of our cases had tuberculous ulcers of the colon, but it is hardly probable that the severe hepatic infection had its origin from this source. The history of the case is as follows:

T A T, male, seventeen years old, was operated on at the City Hospital on July 26, 1901, by Dr E H Nichols. A year before he had had a short attack of probable appendicitis. Four days before operation he had had an attack of severe, sharp, abdominal pain in the right side followed by vomiting, chills, marked tenderness, and severe weakness. At entrance he had jaundiced sclera and some tenderness over the hepatic region, the abdomen being soft except over a local mass in the region of the appendix. Dr Nichols found a long, distended, congested appendix in an inflammatory mass. This was removed and the wound drained. The following day the temperature remained high, and there was slight delirium with persistent tenderness over the liver. Two days later the wound was dressed and the wicks changed. Four days later the jaundice was fading from the eyes, the wound looked clean with slight discharge, but the boy had had a chill on this day and the day before. Widal negative, leucocytosis of 10,200. Six days after operation he was having mild chills daily, occasional vomiting, continuation of the jaundice, and extension of the liver border two fingers' width below the ribs with moderate tenderness. He was growing weaker, slept much, but held food both by stomach and by rectum well. The wound was in a satisfactory condition. On the following day there were high-pitched râles throughout the right chest, with dulness at the right apex. The pulse had increased to 140, the boy vomited twice and had severe chills. Considerable pus or foul matter escaped this day from the wound. Tube replaced. He improved a little for five days, and then had chills again, with a temperature of 106.5° F, the liver still being enlarged and tender.

August 5, I operated because of jaundice, irregular chills, vomiting, rapid loss of strength, and hepatic tenderness. At no time had there been spasm in the flank. At operation the right lobe of the liver was found enlarged and cedematous posteriorly, but showed no evidences (such as localized swellings) of abscesses in its substance. A director was passed into the liver in various places without reaching pus. Along the spine, a large

fluctuating gland, the size of a hen's egg, could be felt about the level of the lower end of the kidney. Above this were several swollen glands in a chain about half an inch in diameter. The larger gland was opened, a drachm or two of foul pus being evacuated, and packed with iodoform gauze. The wound was partially closed, space being left for the exit of an iodoform gauze wick passed down to the liver punctures, and of a drain from the gland abscess. Exploration of the appendix sinus was negative.

Five days later, when the wound was dressed, there was a slight purulent discharge, the temperature was still quite high, and patient was more drowsy and more septic looking. He had vomited the same night, and the temperature rose to 106° F and pulse to 144. On the 13th the pulse and temperature were making wide excursions up and down, the patient was growing weaker, the sclera had become more jaundiced, and he was losing ground. Under chloroform, exploration through the sinus showed an area of necrosis of the colon about the size of a five-cent piece that broke on examination. From this area a narrow band of necrosis of the gut extended towards the mesentery as if from a thrombus. Exploration below this area showed almost total subsidence of the gland that had been previously opened, but below it in the iliac fossa were two or three small glands, one of which contained about a half a drachm of pus. Nothing abnormal could be found in the liver or elsewhere in the abdomen. The cavity was drained with iodoform gauze. The patient was in poor condition, but stood the operation fairly well. He steadily failed, however, and died two days later. Urine negative throughout.

Autopsy showed the mesenteric lymph-nodes enlarged from  $\frac{1}{2}$  to 2 cubic centimetres in diameter, and grayish pink on section. Behind the cæcum was a large node 3 centimetres in diameter, with a caseous and calcified centre. Another node higher up had a soft, purulent centre. Branches of the superior mesenteric vein from the lower part of the ascending colon contained clots. In the region of the hepatic flexure of the colon was a deep, punched-out ulcer with stitches round about it. Nearer the cæcum was a second deep, punched-out similar ulcer, smaller in diameter. The liver showed numerous small abscesses, 1 to 3 centimetres in diameter. Diagnosis: thrombosis of the superior mesenteric vein and its branches, suppurating pylephlebitis with multiple abscesses of liver. Ulcers of the colon, chronic tuberculosis of the retrocæcal lymph-glands.

(For detailed autopsy report, see *Boston City Hospital Reports*, 1902, page 147 )

Loison (1900) states that the appendix adhering by inflammation to the parietal peritoneum enters into direct relation with the lymphatic vessels that lead to the diaphragm, and says that an abscess may form in the retroperitoneal tissue, producing the type designated as paratyphlitic by Oppolzer and others

Koerte holds that the appendix may not even become adherent to start the infection, the invasion taking place between the folds of the mesentery He regards this form of infection as less virulent than that which takes place through the portal tract, this is probably true because the barriers against an overwhelming dose of poison are less evident in the portal circulation than in the lymph channels Even if the infection has reached the liver by the lymphatics, its spread there will be less active than if brought directly along the portal tract

Robinson (quoted by Loison) explains some cases of transmission by the passage of pus along the parietocolic sinus which runs from the appendiceal region to the inferior surface of the liver, where it ends in quite a pocket in which pus may collect remote from the rest of the peritoneal cavity This observation probably explains the findings in the following case of ours, although it is possible that the pus in this pocket may have been secondary to an abscess of the liver that had emptied spontaneously

C E M , male, forty-two years old, was seen May 19, 1904 He had been treated by his physician, since April 23, for typhoid There was a history of fever, malaise, tenderness in the right iliac region without vomiting Tenderness over the appendix was definitely marked The temperature had ranged from 100° to 102° F and the pulse from 100 to 120, rising steadily A few days before I saw him there had been chills There had been slight jaundice at first, not noted in the eyes, but in the skin, with bile in the urine This had improved The patient was restless and hiccough had been troublesome There had been tenderness over the right lobe

of the liver, and slight delirium at times The patient stated to me that he had been well up to a sudden attack of abdominal pain at the beginning of his illness, although he had been feeling poorly for a week or more before that Examination showed a very sick, wasted, anæmic patient with a dry, dirty tongue, he was slow mentally but intelligent He had a poor, thin pulse, rapid, but regular The abdomen was dry and distended, but without spasm Deep in the right loin was a tender mass, feeling like an enlarged right lobe of the liver in its lateral half Under the right costal border there was also tenderness and swelling of the liver Left lobe palpable Spleen not enlarged to percussion There was doubtful increase of tenderness over the appendix The upper border of the liver was an inch or more above normal No jaundice Patient was much worse since his chill two days before my visit, and seemed too sick to warrant interference A fatal prognosis was given, but, if under feeding and stimulants he showed signs of rallying, operation was advised In a few days the patient was taking double the amount of nourishment, the pulse had dropped a little, and the temperature had fallen to normal He was better mentally and there was less abdominal tenderness Shortly after this he entered the Quincy Hospital, where operation took place two and a half weeks after my first visit Under ether the abdomen was opened over the right hypochondriac tumor and a foul abscess, involving the under surface of the right lobe and the adjacent portion of the peritoneal pocket, was opened It was impossible to determine whether the abscess had originated within the liver or had penetrated its lobe secondarily There was evidence of old trouble around the appendix, but the patient was in too poor condition to justify prolonging the operation, so the abscess was drained, and the patient after a rather stormy course for a few days steadily and slowly recovered Appendectomy was reserved for a later operation

Nash, in a child of fifteen, found pus in a cavity between the colon and the layers of the mesentery which was adherent to the under surface of the liver On separation of the adhesions the liver was found rough and broken down There were also broken-down retroperitoneal lymph-nodes Here there was not only an invasion of the lymph channels, but the

liver was invaded by direct implantation of an abscess pushing itself along the cellular tissue. This same condition has been seen in one or more of our cases, and Cantlie has reported a similar case.

Abbadie recognizes infection by the lymphatics, but considers it exceptional, the main origin being through portal invasion.

Infections are not necessarily limited to the liver, as we may find at the same time abscesses of the pancreas, spleen, pleural cavity, lungs, etc.

Cantlie, in an autopsy on a case of hepatic abscess, found that the pus had burrowed up between the diaphragm and liver from a large perityphilitic abscess, the abscess in the liver coming this way and not evidently by way of the portals.

Perihepatic abscesses, secondary to empyema, may be found, and it is possible that an empyema starting from a pneumonia which exhibited the peculiar abdominal signs so deceptive in its earlier stages might easily cause hesitation in locating the true origin. Such abscesses are less likely to contain foul pus, and, indeed, in a case reported by Beule the pus was sterile.

It would be interesting to differentiate the lymphatic-hepatic cases originating in appendices intra-abdominal in position from those where the appendix, as a result of some developmental process, is partly or entirely extra-abdominal. In some cases this is impossible, because, either as a result of previous attacks or because of extensive destruction in the present attack, all anatomical landmarks are obliterated, and an organ originally freely movable within the general cavity may have become firmly ensconced behind the cæcum with a new peritoneal covering.

An appendix adherent to the peritoneum over the iliacus may perforate on its under side and directly infect the retro-peritoneal space without involving the peritoneum (Hawkins). Such cases may extend downward instead of upward and be opened in the groin, thigh, or even in the opposite groin. Gallant has reported three such cases where the infection was found in the pelvis behind the peritoneum.



Koerte, in the *Berliner klinische Wochenschrift* for 1892, has reported a case of a man, twenty-nine years old, in whom, after an attack of appendicitis, he had resected the tenth rib in the postaxillary line, opening a foul abscess cavity in the liver. At autopsy an abscess of the liver and subphrenic space was found, and a perforating appendix with abscess. Behind the colon a passage, containing pus, led upward to the round edge of the liver, whence a tract extended outward to an abscess between the spine and right pleural cavity. Such cases, starting in all probability behind the cæcum, are reported by Brewer and many others. We are inclined to believe that the appendices that originally are extra-abdominal, and without any peritoneal covering, are presumably less able to direct the lymph currents within the normal channels, and so give rise to the most fulminating types of lymphatic poisoning. In this connection the following case illustrates how unrelenting such an infection may be from the outset.

M. McC., female, aged twenty-five years, was seen March 12, 1899, with Dr. Washburn. She had been ailing for a year, and was supposed to have some ovarian trouble. Four years ago there had been some form of obstipation, from which she recovered in two days. Three days before I saw her she had had sharp pain in the lower right abdomen, nausea, and chills. The day before my visit she was comfortable, but the temperature was  $103^{\circ}$  to  $104^{\circ}$  F., and the pulse 120. She looked ill and had general abdominal tenderness with slight spasm. In the right side over the appendix there was acute local tenderness. A diagnosis of acute appendicitis was made and operation was done at once. On opening into the subperitoneal fat, pus escaped from towards the pelvis, but on opening into the peritoneum, only one coil of small intestine was found lightly adherent with lymph. Opposite the abscess in the cellular tissue the peritoneum was opaque and injected, otherwise, there was no evidence of trouble. A further exploration of the retroperitoneal space showed a cloudy, oedematous infiltration extending towards the kidney, and, on peeling back the peritoneum towards the median line, search for the appendix was made in vain. There was considerable thick, inflammatory deposit on the iliacus with a slightly honeycombed appearance, from which thin pus escaped. The patient stood the

operation fairly well, but the pulse was 140 to 160 throughout, though of good volume. The following day she was not so well. The wicks in the retroperitoneal space were dry, without evidence of serum or pus, and the peritoneal flap looked gangrenous. Two days later the patient died. Autopsy by Dr R. M. Pearce seven hours postmortem.

"Abdominal cavity. Intestines are markedly distended with gas and bathed in a thin yellowish purulent fluid. Where in contact the coils are united by yellowish white fibrinous exudate. In the pelvis there is considerable free purulent fluid. Blood-vessels of intestine are much injected. The surface of the liver and spleen is covered with fibrinous exudate. The cæcum with the appendix lies completely behind the peritoneum. The appendix is bound down to the cæcum by easily broken adhesions. Its distal end is collapsed. At about its middle is a constriction, between which point and the cæcum the appendix is distended and injected. On opening up the appendix thin pus is found throughout its lumen, but in greater amount in the proximal half. The mucous membrane of this portion is also very much injected, but there is no ulceration, no foreign body. In the loose areolar tissue lying behind the peritoneum in this region a thin layer of purulent fluid can be seen extending up as high as the middle of the right kidney.

"Anatomical Diagnosis. Acute appendicitis, acute general purulent peritonitis, acute splenic tumor, retroperitoneal lymphangitis, peritoneal exudate.

"Smears show pus-cells, fibrin, bacilli, and short chains of flattened diplococci (evidently streptococci).

"Cultures show colon bacillus and streptococcus, the latter abundant."

*Portal Infection*—The majority of abscesses of the liver are reported in connection with dysenteries of one sort or another, mainly tropical. A study of these throws light on the abscesses that come from appendicitis so far as method of origin, location, etc., are concerned, but when it comes to treatment, the story is far different, mainly because of the extreme difference in the degree of infection of the two types, and also because of the proclivity of abscesses originating in perityphilitis to assume the diffuse miliary type.

Some of the earlier abscesses which were described as pyæmic can be explained as typical portal infections, so far as the clinical history and the post-mortem findings show (Cases of Ashley, 1879, and others )

In earlier reports we find abscesses of the liver ascribed to a dysentery where incomplete autopsies throw no light on the true origin, but where a careful study of the clinical history points to an overlooked appendicitis (Cases of Balfour and others )

The mode of infection and its pathology are so well known that it need not be taken up here at all It is the most frequent source of typical intrahepatic abscesses As some of our cases show, it is not uncommonly associated with a recognizable degree of lymphangitis, though the latter proves not to be the source of the abscesses in the liver Whether this association indicates a special virulence of the infecting agents or a lessened resistance to the invasion both on the part of the veins and of the lymphatics, cannot be told from the few data at hand The association is not referred to by writers in general, but our clinical experience would incline us to believe that it is more than a chance one To illustrate this, one of our cases may be reported here

H C B, male, aged thirty-five years, had had several attacks of severe abdominal pain and vomiting in the past six or seven years Each time he had been a little yellow, but without chills, and the attacks lasted only a few days Three days before entrance to the hospital on April 25, 1901, he had a sudden severe attack of appendicitis followed by slight jaundice and a leucocytosis of 13,000 He was treated in the medical wards for a month, during which time he had occasional chills with high temperature, epigastric pain, progressive emaciation, variable jaundice, and leucocytosis increasing steadily up to 43,000 at the time when I saw him on May 27

Examination showed a much emaciated, jaundiced, septic-looking man, with an enlarged liver, especially marked on the left, and with doubtful tenderness over the appendix Under ether the abdomen was opened in the median line above the umbilicus

One small pinhead abscess was found on the anterior surface of the right lobe. The left lobe was uniformly enlarged, but on the under surface there was a deep, slightly indurated swelling. This was opened, and a cavity containing pus was found. Careful examination of the right lobe failed to show any nodules suggesting abscess, and exploration failed to show pus. The gall-bladder and neighboring region were normal. The appendix, subacutely inflamed, was removed through a small opening. The patient was in poor condition before operation, but on the following day the temperature had fallen to normal, and the pulse had fallen to 120. There was considerable discharge from the liver. Three days later the temperature remained down, but the pulse was rapid and weak, and he looked badly. Two days after this the patient, in straining, broke open the appendix wound, and had a prolapse of intestines which, when discovered, were dark and strangulated. The intestines were replaced and the wound packed, but the patient gradually failed and died.

Autopsy showed between the spleen, stomach, left side of diaphragm, the liver, and posterior wall of the peritoneal cavity, an abscess containing offensive, yellowish, semifluid material. All the mesenteric lymph-nodes were somewhat enlarged. One node was softened, and contiguous to it was a canal, that is, a mesenteric vein, with roughened yellowish wall admitting the little finger and communicating directly with the portal vein. On section through the left lobe the portal veins were dilated and contained pus. In the right lobe, particularly towards the superior surface and the right, were numerous small abscesses arranged in clusters, 3 to 5 centimetres in diameter. Smears from the portal veins and subphrenic abscess showed streptococci.

Diagnosis left subphrenic abscess, mesenteric and portal pyophlebitis, acute general peritonitis, multiple abscess of the liver. The case also illustrates the additional infections by direct extension to the subphrenic region.

(For a full report of the autopsy, see *Boston City Hospital Reports*, 1902, pages 146-184.)

"That infection from a thrombophlebitis is not more common is surprising when we consider the free circulation that exists between the mesenteric and portal vessels. But as

a matter of fact, it is only an occasional complication" (Fowler) I would venture to suggest that the complication is more common than statistics, especially postmortem, indicate, because I believe that mild infections do take place from which the patient recovers spontaneously But more of this later on

Infection in the left lobe as well as the right may take place through the portal channel, but there is almost always a more pronounced infection in the right lobe owing to the anatomical relations of the portal branches Yet Jackson in an autopsy of a case found the left lobe more extensively riddled with abscesses than the right, showing that the process was either older or more rapid in the left side This was one of the earlier cases that I saw with Dr Jackson, and has been reported in full by him in the *St Paul Medical Journal* for 1899

Very suggestive in this respect is a case that I saw with Dr V Y Bowditch, and, though we have no post-mortem findings, the clinical signs pointed to a left lobe enormously enlarged as compared with the right The case is as follows

M McA, female, aged twenty-seven years Five or six weeks before I saw her there was a very definite history of an attack of mild appendicitis followed in about a week by symptoms severe enough to require her to go to bed Soon she had irregular chills, which had continued more or less ever since No jaundice was noticed until within the last ten days, when there had been a slight tinge of yellow Recently she had had severe chills daily, sometimes lasting for an hour The temperature had been irregular, but it was taken at irregular intervals Her physician, supposing it to be a case of tuberculosis, referred her to Dr Bowditch, who in turn diagnosticated it as portal pylephlebitis In her attack six weeks before I saw her, she gave a history of tenderness in the right iliac region, and an area of exquisite tenderness in the right loin The urine was negative She had recently been seen by another consultant, who made a diagnosis of general tuberculosis At my visit I found a tender, swollen left lobe of the liver extending down to the

level of the umbilicus in the flank and sloping upward across the median line to about the eighth or ninth cartilage on the right. The right lobe was swollen, but much less so than the left, the lower border coming down only about an inch below the ribs. Both lobes could be felt posteriorly in the flanks. There was slight distention and general tenderness on deep palpation over the entire abdomen. I could detect no jaundice. There was slight œdema of the abdomen over the loins. Leucocytosis, 10,000.

I again saw her four days later. The temperature had continued at about 102° to 103° F. The pulse was steadily rising to 120. She was delirious and had had a chill every day, vomiting more or less. The left lobe was of the same size as before, but on the left border it seemed a little more superficial, with a definite area of tenderness. There was distinct parietal œdema by this time. Right lobe same as before.

In a small area low down in the anterior axillary line over the upper surface of the left lobe there was a friction rub. She had had two serious attacks of collapse.

The case was transferred to my care for operation if thought best, but the patient was in so desperate a condition that I advised against it unless there was evidence of some gain under stimulation. Two days later, although stimulation and rectal feeding had been carried on, the patient was definitely worse. She was delirious most of the time, with beginning œdema of the lower extremities, and was too ill, in my judgment, to warrant interference. She rapidly lost ground and died a few days later.

No autopsy was obtained.

One of our earlier cases, a boy of eleven, at operation, exhibited a left lobe much swollen and pushing the right lobe far to the right and backward, so that the abscess in the former lay under the right rectus. An abscess in the right lobe was also opened opposite the tip of the twelfth rib. In this case the epigastric tumor before operation was naturally supposed to belong to the right lobe.

Another of our cases showed a predominance of abscesses in the left lobe, and is worth detailing on that account as well as on others.

W C, male, thirty-six years old Operated upon April 5, 1903 There had been a history of preceding attacks of appendicitis, and an attack just before his entrance to the medical wards two weeks before I saw him At one time there was slight jaundice He had an epigastric tumor, which, being aspirated by the visiting physician through the abdominal wall, gave exit to pus When transferred to the surgical wards he was delirious and septic, with a fat, distended abdomen This was opened in the epigastrium and free pus was found in the neighboring abdominal cavity, with a large group of confluent abscesses ready to break in the right hepatic lobe The mass was broken up and found to extend directly through the organ to the under surface The abscess cavity was drained with gauze

A second incision was made over the appendix and an abscess opened up there The cæcum, gangrenous and accidentally opened, was brought up and sutured to the surface The patient was in bad condition and died within forty-eight hours A partial autopsy showed three groups of abscesses, that which had been opened being in the right portion of the left lobe instead of in the right lobe as was supposed at the time of operation Another group lay at the dome of the left lobe, and a third group in the left edge of the left lobe

These abscesses were undoubtedly portal in origin, there being no evidence that they were direct infections from a left-sided peritonitis Aspiration had resulted in soiling the cavity with the contents of the abscess, but that had happened only two days before operation

*Time of Formation of Pus* —There must be a considerable variation depending on the individual, the type and amount of infection, etc., in the time required for the formation of pus in appreciable quantities The clinical data on this point are very vague, but apparently there may be a wide variation in certain instances One of our cases is of interest in this regard

C D, male, aged thirty-five years, entered the hospital August 11, 1896 Five months previously he had had an attack of appendicitis with tenderness and vomiting, followed by a second attack six weeks later, more severe in character The

day before entrance an attack came on with pain over the appendix, vomiting, malaise. As he continued to grow worse operation was done at once. I found acute localized appendicitis. The appendix was removed and the cavity was drained. On August 30 there was a healthy sinus about an inch deep. Then the temperature, which had been normal, began to rise. Soon he had more or less vomiting, and a chill.

September 13, the pain over the liver had increased, and over the right lower chest there was a friction rub. Under ether the abdomen was opened and the liver explored for pus in vain. No improvement followed, and the wound of this operation was healing kindly when, seven days later, on September 20, it burst apart and much foul pus mixed with bile escaped. On the following day the patient had a chill and was much worse. The upper wound was draining and its cavity was washed out. He then improved, the chills ceased together with the vomiting, and there was free discharge of bile and pus from the sinus. On October 4, the patient had lost ground again with several chills and profuse discharge of bile-stained pus from the operating wound. The cough which he had had for some weeks continued and vomiting again began.

October 12, there was much foul discharge from the operating wound and a profuse foul expectoration with occasional chills and vomiting. He took plenty of food and stimulants, however. The expectoration and the discharge from the wound continued up to about November 8, when the temperature fell to normal, the cough ceased, and the patient steadily improved, being discharged December 7, looking and feeling well. When seen several years later he was well and strong.

This case illustrates the lateness at which hepatic infection may follow the original appendicitis, and at a time when presumably all reasons for apprehending a mesenteric phlebitis are passed. As an example of the spontaneous cure by evacuation through the lungs it is also interesting, and it is a question whether recovery might not have followed without the anterior drainage of the liver.

A case of pneumonic infection of the liver illustrates the enormous rapidity with which a general enlargement may take place.



E H, male, aged twenty-three years, was transferred from the medical wards of the Carney Hospital where he had had the crisis in an attack of pneumonia two or three days before. This was followed at once by return of high temperature and high pulse, the latter increasing in the last day. He was delirious with jactitation. The liver had increased rapidly in size within the last twenty-four hours, the lower border reaching to the umbilicus.

There was an indefinite history of previous appendicitis. A diagnosis of liver abscess was made.

Operation under primary ether. The abdomen was opened through the right rectus, and the liver was found much enlarged, dry, hard, and smooth, but without mottling. Abdomen elsewhere negative. Most of the enlargement of the liver was in the right lobe. It was explored in various directions with a director, but only once did anything escape looking like granulation tissue. The wound was closed, allowing for an iodoform gauze wick to the upper surface of the liver. Patient died within twenty-four hours.

McClelland has reported an interesting autopsy in this regard. A rapid enlargement of the liver took place after an appendix abscess, caused by a pin, the liver extending down to the umbilicus. There was no jaundice, the patient being typhoidal for a week, when he died. In the right lobe were one large and numerous small abscesses. The left lobe was enlarged but free from abscesses. It is unfortunate that the clinical signs of swelling of the left lobe were not noted. It is probable that its enlargement started some time after enlargement of the right lobe was first noticed.

In Thompson's article on "Pylephlebitis," in *Boston City Hospital Reports*, 1902, one of the autopsies showed "no abscess in the liver, though the branches of the portal vein in the liver substance were filled with pus, and the increased connective tissue in the liver seemed to show the process to be of some duration."

Sheen in 1896 reported an interesting case bearing on this subject.

A woman of twenty-seven years had an appendiceal abscess opened, the appendix not being found. No improvement ensued, but delirium,

jaundice, and chills came on, and a month later a large mottled liver was explored with negative results. The jaundice then faded, but an abscess in the neck required operation. Three and a half months after the first operation, during a slow convalescence, swelling appeared in the right lumbar region. This was opened between the ninth and tenth ribs and foul pus evacuated. Recovery followed. The history certainly suggests a typical portal infection, and in the light of the slow progress in some of our cases it is not at all impossible that an area of infection limited in extent had lasted for that long period.

*Interval between the Attack of Appendicitis and the Manifestation of the Hepatic Abscess*—This varies within very wide bounds. It apparently may take place almost directly with the onset of infection in the walls of the appendix, or it may be delayed for weeks or months. Moreover, the appendiceal evidences may have subsided to such an extent that it is easily overlooked as even a possible cause. There are numerous illustrations of this in literature.

Lelong reported a case in 1891 which, judging by his account of the symptoms, had had definite attacks of appendicitis some time before entrance to the hospital, with chills, jaundice, etc. A month later autopsy showed a subsiding appendicitis with only a little pus in its lumen, and abscesses in both hepatic lobes. This picture can easily be carried a little farther, and one can imagine an appendix at autopsy showing nothing beyond a slight thickening of its coats or a few punctate hæmorrhages coincident with a liver riddled with foul pus. In such a case it would not be easy to convince the pathologist that the *fons et origo* lay in the innocent looking appendix, but the clinician who can seek back and elucidate the undiagnosed attack of appendiceal infection that was present a few weeks earlier will be inclined to ascribe the hepatic lesions to this rather than to some less apparent cause.

Gruneisen found that five days was the shortest interval between the beginning of the disease and its manifestation in the subphrenic space. In most of the cases the interval was about two and a half weeks. It is easier to imagine a much more rapid transportation of infection by the portal channels than by the lymphatics, and I am inclined to believe that such

is the case. If so, it would necessarily limit Gerster's suggestion of eliminating the nidus of infection in the mesenteric lumen at the time of removal of the appendix.

That spontaneous healing is not impossible nor even infrequent, in cases of mild infection, I think is shown by the recovery at times of patients who show the typical signs and symptoms of hepatic abscesses in the course of an appendicitis. There is, of course, neither operative nor post-mortem proof of this observation, but the clinical evidences are very convincing.

The experiments of Lemaire showing that the liver offers to the colon bacilli protection against a general infection up to a certain extent would help to bear this out. He shows that the work is done mainly by the endothelial cells of the hepatic capillaries, purification of the infection, if not too virulent, taking place within a few hours. That such a purification may come about in portal invasions seems not impossible.

Legg in 1875 exhibited a case of infection where there seemed evidence of healing in some of the hepatic abscesses. In this instance there had been an appendicitis caused by a pin, followed by a general peritonitis.

Reichardt in 1903 stated that abscesses may occasionally heal by encapsulation, and Tillmanns speaks of the cicatrices that occur from the resolution of small abscesses.

In this regard we must consider a curious case reported by Treves, in 1894, of a young girl of fifteen who had had several attacks of appendicitis. About a week after the attack in which he saw her, she had rigors which occurred irregularly for a week. She steadily lost ground, became emaciated, typhoidal, and delirious, but was not jaundiced. A month after the beginning of the attack Treves operated, and found a normal looking appendix without peritonitis. The liver, however, was evenly enlarged, soft, and the surface was covered with minute yellow specks. There was neither ascites nor adhesions. The liver was not explored, but the abdomen was closed and recovery followed from that date. He could give no explanation for the result, unless it was because of some change in circulation following operation. The evidence, of course, is not convincing that it was a simple case of infection, although the history and appearance of the liver are very suggestive.

We have seen a similar result follow exploration in a case with chills, delirium, jaundice, and enlarged, tender liver that

before operation was supposed to be an acute portal infection, but at operation was diagnosticated as an acute hypertrophic cirrhosis. Our case was treated for alcoholic cirrhosis (atrophic) a year or so later, but in Treves's case there seems no reason to suspect alcohol as the origin.

The following case reported by Bryant with autopsy is of interest in this regard. Male, eighteen, admitted with sinuses in the left groin which had persisted for three months. During this time he had had several attacks of jaundice. At entrance, foul, green pus came from the sinuses. A month later an abscess above the iliac crest on the left was opened and a large quantity of pus evacuated. Four months later there was swelling in the right groin, which was opened. A month later an abscess was opened on the left below the ribs, from which fecal matter escaped. Death six months after entrance. Autopsy showed an abscess of the appendix as the origin. The liver showed scars of old abscesses. One abscess was in a caseous state. There was some pus in the portal canals. The portal vein was completely blocked by a soft clot.

The medicolegal bearing of these cases may be of interest at times, and a case reported by Koch bears on this point.

A man of forty-eight years was injured in his appendix region in April, being in bed several weeks, but recovered and was able to be around until the following September, when he had an acute attack of appendicitis, which was not operated upon. Three weeks from this onset he had an enlarged liver, was of a pale yellowish color without icterus, and a week later was operated upon. He died three days afterwards, autopsy showing a gangrenous appendix with abscess, and abscesses of the liver.

Stewart in 1901 also reported a case with symptoms of appendicitis following a blow in the right iliac region. Five days later an abscess was opened, and a week later a second abscess in the left side of the abdomen was evacuated. The following day the patient had chills with other signs of sepsis, and in the course of a few days he coughed up foul pus containing colon bacilli. The left pleural cavity was then drained and recovery followed. In this case the infection probably did not take place through the portal route, but either by direct invasion of an abscess in the upper left abdomen or by the left retroperitoneal lymphatics. Its medicolegal bearing, however, is of interest.

The age at which these infections take place is limited mostly to young adults. According to statistics of Musser and others, children below fifteen are quite exempt from portal infections. We have had one case in a boy of eleven reported elsewhere.

Subphrenic abscesses are rare in children from any cause, and from appendicitis they are very rare. Of 169 cases collected by Maydl from all causes, only ten were in children below fifteen years of age. Of these ten only one was primarily infected from the appendix. Jopson has added twelve cases, and of these six were due to appendicitis. Why this rarity should exist it is hard to say, but from the much greater proportion in Jopson's recent collection, it is possible that investigation of the appendix at autopsy and operation has of late been more searching. We have seen two children under fifteen with lymphangitis, and there seems to be no valid reason why the process should not invade the subphrenic space as well.

S J, female, aged eleven years, operated upon by Dr Lund for acute appendicitis on July 24, 1900, five days after onset of the attack. Improvement followed, except that the temperature and pulse persisted above normal, with spasm and tenderness in right lumbar region. On August 13, under ether, I operated, exploring the abdominal sinus and the rectum, but failed to find any well defined area of induration. A short incision in the right loin exposed the kidney, and on pushing anteriorly a double chain of enlarged lymphatic glands was found. At one place granulation tissue surrounded two of the glands, but without evidence of an abscess. The wound was packed with iodoform gauze. Practically, no pus drained from the posterior sinus, but the patient slowly improved and was discharged relieved. It is doubtful if the posterior drainage influenced the progress of the trouble, although the symptoms and the examination at operation demonstrated a moderate degree of lymphangitis. I have seen similar cases quiet down under hot poultices.

B C, female, aged fourteen years, was seen November 28, 1897, with Dr Dorman, and operation performed for acute appendicitis with a large foul abscess extending into the pelvis. The right tube, swollen and inflamed, was removed, together with the gangrenous appendix. Recovery was complete. On May 31, 1899, eighteen months later, I saw the patient again. Since operation she had been well, attending school and riding a bicycle. A few days before I saw her she began to have pain in the appendix region, with elevation of pulse and temperature, but no

chills Some fulness and tenderness with spasm were found in the region of the appendix The tenderness appeared to be along the outer edge of the iliacus, not extending towards the kidney Slight spasm of the abdomen The scar was solid Three days later, as the pulse and temperature did not subside, I operated, making a short incision alongside the scar to explore the peritoneal cavity, but no evidence of peritonitis was found The psoas and iliacus were swollen in the line of the sulcus The wound was then closed, and an extraperitoneal dissection carried on through a second incision until a small abscess cavity was found containing foul, stinking pus, and a concretion of the size of a pea at the ilio-psoas junction This cavity was curetted out and drained and recovery promptly followed

The pleurisies secondary to typhlitis are fascinating as studies, but they represent only a more advanced step in the class of cases that we are considering, and therefore I shall allude to them only briefly in order to round out the clinical picture

Lepeyre (quoted by Abbadie) divides them into two classes (*a*) those pyohemic in origin, in which case they may be on one side or the other, and (*b*) those caused by direct propagation, here they are always on the right side, the left-sided types being due to infarcts The infection is also carried directly, that is, mechanically or by the lymph channels, along the parietocolic sinus, starting from a reticocolic abscess at any distance from the appendix From this focus there is uninterrupted continuation of the lesion up to the diaphragm The parietal lymphatics only play an accessory rôle

*Diagnosis* —A diagnosis of either the lymphangitis or the pylephlebitis that is secondary to appendicitis is at times impossible In typical cases it ought not to be difficult Fortunately, both conditions are comparatively rare, hepatic abscess being estimated as present in from 5 to 10 per cent of all cases of appendicitis At present there seems no way of estimating the frequency of retroperitoneal lymphangitis The grave types are probably less frequent than the portal invasions.

In relating the various diseases with which these appendi-

ceal infections have been confounded, one is surprised at the apparent effort made at times to escape the obvious source of infection. It has been variously mistaken for pyæmia, septicæmia, typhoid, malaria, spinal caries, rupture of a reduced hernia, general miliary tuberculosis, etc. It need not be inferred that the diagnosis is always plain, because the individual types unfortunately vary within wide limits, and all of these diseases may be mimicked to a greater or less extent, but when a careful history can be obtained and when we realize the great frequency of appendicitis, we ought to consider at least the probability in cases exhibiting sepsis, jaundice, hepatic tenderness, with surgical spasm over the appendix region. Typhoid is quite commonly the diagnosis made, but the marked difference in pulse-rate from the very outset and the lack of Widal reaction should be of assistance. So with malaria,—the blood examination, the irregularity of the chills, the disproportion in the size of the liver and spleen, and the definite hepatic pain and tenderness should prevent mistake in most cases. One of our cases was confusing because of the presence of plasmodia. The history is as follows.

L. P., male, aged nineteen years, had been in the medical wards for about ten days with chills, and a leucocytosis increasing from 13,000 to 40,000. Plasmodia were found, but they disappeared under quinine without affecting the chills. There was marked loss of strength with tenderness over the liver, which had increased downward in size. Eight days before entrance he had had an attack of probable appendicitis, with a history of a similar lighter attack the year preceding. There was slight jaundice, enlarged spleen, and fulness and tenderness in the right hypochondrium. Slight tenderness over the appendix, which apparently was palpable.

Operation. incision through upper abdomen on the right side. The right hepatic lobe was much enlarged, the left lobe was apparently normal. The posterior and under portion of the right lobe was slightly mottled, indurated, and irregularly nodular. It was opened freely on the under surface and a large area of porky, trabecular tissue without pus was broken up with the finger.

From in front another opening was made into similar tissue, and the liver was freely broken up with the finger. Bleeding, which was free at first, was easily controlled by packing. The appendix was found, through a second incision, lying in a small abscess full of stinking pus. This was drained. The patient was in a bad condition and required stimulation. The hepatic wound was packed with gauze.

Two days later the patient was much better, with a pulse of 90. The discharge was not yet bile-stained. Three days after operation the pulse suddenly jumped from 90 to 140, the respiration became much more rapid, and he died four days after operation. The dressing done on the third day was stained with bile, but not with pus.

Another case presented meningeal symptoms that were very confusing at the time of examination, although a diagnosis of lymphatic infection was made. The history is as follows:

A F, female, twenty-five years old. In July, 1903, the patient had had an operation for lacerated cervix, the operation was followed by acute vomiting for ten days. After her return home she was well for two weeks. The present attack began six weeks before I saw her in October, with abdominal pain and tenderness which lasted for three days. Then followed vomiting and diarrhoea, dysenteric in character. Abdominal tenderness persisted throughout the attack. Chills preceded the vomiting. No jaundice was noted. After vomiting two weeks she became very tender in the right hypochondrium, lost about thirty pounds, and recently, following severe headaches, she had become blind. At the beginning of the present attack the temperature and pulse were high for a week or ten days. It then fell to normal, and no record was kept by the attending physician until Dr. O'Keefe, with whom I saw the patient, took charge of her a few days before my visit, he found a temperature of 102° F and a pulse of 120. At my visit I found the patient apparently blind, with dilated pupils and nystagmus. No paralyses, anæsthesia, nor change in the reflexes were found. She was emaciated and sick looking, with a moderately distended abdomen, visible coils, general abdominal tenderness, more marked over the appendix.



region, while in the right loin there was spasm. The liver was not enlarged to percussion. Heart and lungs negative. The pulse was thin and rapid. Diagnosis: appendicitis with lymphangitis and abscess of the brain. She was transferred to the City Hospital that same evening, but was too ill to warrant operation, and died within twenty-four hours. Autopsy showed an appendix sloughed off from its base, gangrene of the cæcum contiguous to the appendix, and a foul retroperitoneal lymphangitis. The brain was normal, and nothing was found to account for the blindness. Following is the detailed report of the autopsy.

**Peritoneal cavity.** The serosa is smooth, gray, and glistening. Transverse colon has a V-shaped fold extending nearly to the symphysis pubis, mesenteric lymph-nodes not notable. On lifting the cæcum, the appendix is found to be obliterated. At its site is a small hole into the intestines. About this the cæcum is somewhat reddened and covered with patches of yellowish fibre. Just above the cæcum, behind the right kidney in the retroperitoneum, is an abscess cavity 8 centimetres long and 3 centimetres wide filled with dirty, yellowish gray fluid. The cavity is ragged and shreds of fibrin adhere to its edges. In the liver no portal infection was found. Anatomical diagnosis: obliteration of appendix with adjacent abscess cavity. Early aspiration pneumonia, slight chronic colitis, fatty change of kidneys, fatty infiltration of liver, pyoureter, œdema of brain substance.

It does not seem possible that a retroperitoneal phlegmon could be mistaken for a renal sarcoma, yet the following case illustrates this most typically!

D. B., male, Italian, thirty-six years old. At Thanksgiving, before his entrance to the City Hospital, he was operated on by a local surgeon at a hospital in a neighboring city, a short right lumbar and a long anterior incision parallel to the costal arch being made. Both wounds were closed at once, without relief to his symptoms. It was supposed at the time that the tumor encountered was malignant. On careful questioning, a history of probable attacks of appendicitis, coming on both before and after this operation, was obtained. Examination showed fever, 16,000 leucocytes, definite appendiceal tenderness, no lumbar spasm, a general septic appearance, and a large retroperitoneal tumor extending

from the kidney nearly to the brim of the pelvis, tender on pressure After several days' rest the general and appendiceal tenderness subsided somewhat

At operation, January 16, the abdomen was opened alongside the rectus No peritonitis was found Behind the peritoneum was a hard, dense growth pushing forward, so that its surface lay quite close to the anterior wall The lower edge just above the pelvic brim stopped abruptly On following down the cæcum, the appendix was found coiled and buried posteriorly in old and recent adhesions, inflamed, and closely fixed to the cæcum by adhesions, but not, apparently, because of its being retroperitoneal This was excised and the stump inverted On exploring upward on the outer and posterior wall of the cæcum, the finger burrowed through a mass of granulation tissue into a definite abscess cavity containing an ounce or more of thick pus lying in the midst of a thick dense wall of inflammatory tissue The kidney could not be definitely located, but there was no evidence that it was involved The cavity was curetted out and drained with iodoform gauze Later he was again explored in the back by Dr Lund, and a small supernumerary kidney was removed on the supposition that it was a gland The diagnosis of retroperitoneal lymphangitis was confirmed Four months later a letter from the patient informed me that he was almost as well as ever

In jaundice due to catarrh or stone the pulse is markedly slow Later, of course, infection may take place along the ducts or the capsule of Glisson, and we may then find secondary abscesses with typical rapid pulse, etc, but the preceding history is a long one, often with colics, etc

From pneumonias or empyemas, especially if ushered in with abdominal spasm, the distinction must be difficult and, at times, impossible When the appendix infection is manifested only by subphrenic phlegmons or abscesses, an accurate differential diagnosis may be most difficult The X-ray, the fleeting and non-characteristic abdominal spasm, the predominance of pulmonary signs, and the sputum will aid in diagnosis

Retroperitoneal lymphangitis may be confused with a form of perinephritis that is found in children, of which W R Townsend has recently reported several examples This form

of infection apparently comes on the left as well as on the right side, and its origin is not definitely known. Trauma may produce it, and it may prove fatal in cases where there is sub-parietal injury of the kidney itself. In his cases there seemed to be no reason for suspecting infection from the appendix, though he mentions it as a possible source. The following case of mine may fall in this class, but when we consider that the appendix infection was a possible cause, it seems better to adhere to that as the origin until a better one for this lesion in general is elucidated.

J S C, male, ten years old, was operated upon in 1898 for acute appendicitis one week after the onset. The abscess cavity was found full of gas and foul pus, and the remains of a gangrenous appendix were removed. A pocket was also found extending up the loin towards the kidney and down into the pelvis. The patient made a satisfactory and rapid recovery.

Fourteen months later I was again called to see the patient. He had been perfectly well ever since operation until four days before my visit, when, after playing ball, he became ill and had abdominal colic. He had a high temperature and pulse, was septic, somewhat stupid, and occasionally vomited. Examination showed marked tenderness in the right flank, no spasm of the abdomen anteriorly, but a mass in the retroperitoneal space near the kidney. Operation was advised, but refused. The boy was ill for a very long time, having several relapses similar to the attack in which I saw him, but he eventually recovered under medical treatment. In all probability some form of infection in the retroperitoneal space lay dormant from the time of the original attack of appendicitis only to be aroused later by some minor injury.

Among other sources of infection of the liver the rectum is well recognized, so, too, are ulcers in the stomach and duodenum. In the latter instance it might be difficult or impossible to distinguish at times between a direct extension from a duodenal perforation and an appendix abscess situated high in the abdomen, or between a gastric perforation and a distant abscess in the peritoneal cavity secondary to an associated appendicitis.

Infection from abscesses and gangrene of the lungs, purulent bronchitis, endocarditis, etc., where the arteries are the pathways of infection, may also be found. In cases of an open foramen ovale, infection may pass directly from the venæ cavæ to the liver, and, according to Lassen, may pass directly through the lungs, only to be stopped at the liver.

Weber has shown that between the pulmonary arteries and veins there are connecting branches whose lumen is greater than that of the capillaries, these, too, may afford a pathway for infection.

Among remote sources of liver abscess may be mentioned infections in the upper and lower extremities, osteomyelitis, septic renal tumor, broken-down inguinal lymph-nodes, etc.

All these sources must be considered in dealing with supposed infections from appendicitis, because the elimination of the origin is as important as the recognition of the process going on in the liver or retroperitoneal tissues.

The outlook in both the hepatic and lymphatic infections under consideration is serious, especially in the cases where the infection has invaded the liver by way of the portal channels. The phlegmons, especially those in the lumbar region, may be classed with similar phlegmons elsewhere. A certain proportion will serve as the starting-point for a fatal overwhelming septic intoxication, but the majority, if recognized and freely drained, will recover. Gruneisen states that, when the process has advanced to the subphrenic space, the mortality is about 50 per cent, however, about half of the fatal cases die within the first few days following operation because the disease is not recognized early enough, and septic absorption has progressed too far to be relieved by local drainage. Even with a temporary recovery, later interference may be necessary for secondary empyemas, etc. Those who practise the early and radical removal of the appendix claim that their experience in these lymphatic infections is thereby limited, and this is most probably true. Nevertheless, it must be admitted that often the early phenomena of appendicitis are so mild or indefinite that there is no urgent indication for radical

operation In this early period lymphatic invasion may already have started Furthermore, at times, removal of the appendix even within the first thirty-six hours will not retard the development of a lymphatic infection, and, as some of our cases show, there may be a latent septic deposit incident to an earlier attack of appendicitis, needing only the additional impetus of a fresh irritation to produce a serious condition of sepsis In hepatic abscesses all writers coincide in issuing a grave prognosis The outlook, however, is not hopeless, as some would have us believe The early recognition of the typhlitic focus is one step towards improving the prognosis All portal infections, however, are not the result of thrombosis nor of emboli in gross, in some cases there may be repeated additions of bacterial emboli, a certain amount of which the liver is able to cope with In such cases Gerster's thorough ablation of the appendix and the infected veins of the mesentericolum would prove of value A very suggestive case in this regard came to my notice a few years ago

W B, male, aged nineteen years, was seen at the Quincy Hospital in March, 1901 He had been ill with typhoid fever for five weeks during the preceding fall, but had recovered by January 1, since which time he had had attacks of pain in the bowels coming on about once a week Two days before I saw him there was a sudden attack of typical appendicitis, followed within twenty-four hours by jaundice of the sclera and enlargement of the spleen Under ether a gangrenous appendix was removed and the cavity drained The jaundice at once cleared up and the patient recovered

Despite the fact that when the septic invasion has obtained a foothold, the tendency of these abscesses is to assume the miliary type, they do not always invade all the lobes nor even the entire area of one lobe Small abscesses tend to coalesce, and these again to unite with others to form often large cavities more or less surrounded by smaller foci Abscesses that form by direct extension from the subphrenic, the peritoneal, or the retroperitoneal spaces are more liable to be circum-

scribed than those originating in the portal tract, and the former class gives a much better prognosis after drainage. Perutz, in reporting three recoveries in ten cases, states that the abscesses were single because infected through the retro-peritoneal cellular space.

The difficulty of adequate drainage is shown in a case reported by Abbadie. An abscess of the liver starting two weeks after a subsiding appendicitis was drained anteriorly by Dr. Bureau with temporary benefit. A month later, however, a second abscess was opened through the tenth interspace and pus found on the upper surface of the lobe. Nevertheless, death ensued two weeks later, and autopsy showed an abscess in the meso-appendix, abscesses following the portal branches, a cicatrix at the site of the first operation, and no abscesses in the left lobe.

The number of cases of recovery from hepatic abscess following surgical interference is very small, actually and proportionally. The fact that such may recover spontaneously by evacuation into some organ or through the skin indicates that with intelligent interference more cases could be surgically cured. Bosanquet, Dillard, T. J. Kelly, Jr., Richard, and others report cures by spontaneous evacuation. Sheen, Morton, Loison, and a few more have had similar good results by instituting drainage, so we need not submit to Dieulafoy's statement that all appendicular abscesses of the liver are fatal.

Cyr has shown that 25 per cent. of 500 hepatic abscesses of different origins perforated spontaneously, for the most part into the thoracic or abdominal cavities, and rarely into the intestines, pericardium, etc.

One of the most vital points in dealing with the obscure lesions that concern us here is to determine the source of the infection. It is not now difficult, in the light of modern work on the diseases of the appendix, to trace the infection to that organ where a few years past it would have been overlooked. Many histories of reported cases point with almost absolute definiteness to the mild or acute attack of appendicitis that is chronicled, but to which no weight has been given by the

reporter In a majority of such cases of the last twenty years, where there has been any attempt at recording symptoms, the surprise is that the causative appendicitis was so easily overlooked At the present time there is very little excuse for such an oversight

The diagnosis of the lumbar phlegmon may be made first by recognition of a present or remote perityphlitis, the remoteness extending back for weeks or months, then by fever and malaise, sometimes chills, and spasm of the lumbar region which is practically always present Later, a fulness and tumor may be felt by bimanual palpation Marchand, with whom Piard apparently agrees, notes the insidious character of an infection when it takes place in the retroperitoneal space, and speaks of the mild type of fever that attends it This is quite contrary to our experience As a rule, the average case of appendicitis is not characterized by hyperpyrexia, so that if one of our patients does display an unusually high degree of fever, the first sign we look for is that of an invasion of the posterior lymphatics, and in not a few instances we have found definite indications that have yielded to one or another form of treatment

When the infection has attained the subphrenic space, the symptoms are more varied, and are frequently impossible of interpretation without exploration or operation To quote freely from Gruneisen, we must regard the subphrenic abscess as a circumscribed peritonitis, and hence we often find acute, gradually increasing signs of peritonitis At times there is only dull pain, at other times the disease comes on suddenly with collapse, chill, vomiting, severe pain, etc Sometimes the course is very obscure and the picture of the disease is not clear Pain is inconstant In most cases there is an elevation of temperature On examination, we often find irregular marked arching in the lower portion of the thorax of the diseased side This does not behave in respiration in a normal way The intercostal spaces are obliterated, widened or bulged, and frequently painful on pressure

Lejars often found a characteristic point of very intense

pain The upper boundary of dulness often stands in a convex line, and above the dulness there is found normal lung resonance in case there is no pleural effusion In some cases one can determine a marked change in the upper boundary of the dulness on inspiration The change is small, chiefly because the diaphragm pressed upward is weak and lame If there is gas in the abscess, then there is a clearly marked tympanitic zone to be recognized, which changes with the position of the patient One finds characteristically from above downward, first, normal lung resonance, below this a sharply bounded tympanitic zone, and then a dull area, due to the presence of pus This three-layer arrangement of zones can almost be taken as pathognomonic In left-sided abscesses the heart may be pressed somewhat upward but not to the right, while in right-sided abscesses the heart is pressed very little towards the left The liver and the stomach may be forced down to a considerable degree

In a fair number of cases it is impossible to make an absolute diagnosis of subphrenic abscess The previous history which indicates primary disease in the abdominal organ or in the respiratory organs is of importance With a sudden rise of temperature in such cases, one must consider the possibility of subphrenic abscesses among other complications To distinguish from an encapsulated basal empyema may be impossible Here the preliminary history is often of great assistance Where a subphrenic abscess without gas coexists with an already well-marked pleural effusion, a diagnosis is impossible, or is made only accidentally, when, however, in such cases the abscess contains gas, the limited area of tympany is of great assistance in making the correct diagnosis

The determination of pus by means of the exploratory needle is an important aid in the diagnosis of deep-lying pus cavities Puncture is best made in the region of most marked dulness through the ribs, and in the region where, in case of finding pus, one would eventually operate Often one must make more than one puncture In one case Gruneisen reported thirty-six trials at several sittings



Various modern writers advocate the X-ray as a means of locating these abscesses about the diaphragm, and the following case of ours demonstrates its usefulness most conclusively

W E, male, twenty-six years old, seen August 2, 1902, was referred to me by Dr V Y Bowditch, to whom he had been sent with a diagnosis of tuberculosis. In the early part of June he had had a sudden attack of appendicitis lasting for a week with slight jaundice. After cessation of the pain he was able to get up, but was very weak, three weeks after the onset he complained of pain in his right lung. He then entered a hospital, and the right chest was aspirated with negative results.

Examination of the lung in August showed an occasional snapping râle here and there on both sides. There was neither jaundice nor a history of definite chills. He had lost about twenty pounds, was septic looking and anæmic. There was bulging of the right lower chest, the edge of the liver being a little below its normal position. He was advised to enter the Boston City Hospital at once. A diagnosis of subphrenic or hepatic abscess was made.

August 12, under ether, a trocar was passed through the right chest into the margin of the liver without showing pus. A portion of the ninth rib in the scapular line on the right side was removed. Fine recent adhesions were found in the lower part of the pleura, but neither fluid nor pus was found. The diaphragm was opened and the subphrenic space explored as far as the finger could reach. Still no pus was found, even when a director was passed into the liver in various places. The wound was packed and patient sent back to bed.

He continued to lose ground steadily, and about a week before my second operation he had a sudden and violent coughing fit and spat up some foul, stinking fluid. For a day or so his death was hourly expected, but again he rallied. All this time we were confident that there was infection in the region of the diaphragm, and, although most careful physical examinations were made by various experienced diagnosticians, at no time were they able to locate the trouble with enough accuracy to encourage further exploration. Finally, on September 26, X-ray examination having accurately shown below the diaphragm an abscess cavity which

pushed the diaphragm upward, the patient was given chloroform, and a cross incision was made over the sixth right costal cartilage near its junction with the seventh. The upper surface of the diaphragm presented, but the pleural space was not opened. Upon perforating the diaphragm, a cavity was entered which extended posteriorly apparently over the entire right lobe of the liver. It contained gas and a considerable quantity of very foul, thin pus. A small band of adhesions towards the under surface of the lung suggested the location of the perforation into the lung. The liver was drained and iodoform wicks were put in. No direct communication with the liver could be determined.

After operation there was profuse drainage of pus with a faecal odor, but the patient was already too septic to rally, and he died at the end of three weeks. No autopsy could be obtained.

To diagnose a typical case of portal pylephlebitis should not be very difficult. One of our cases illustrates so significantly the characteristics of the early stages, that I will report it first of all, as a basis.

T S, female, seventeen years old. Ten days before entrance to the Boston City Hospital she had an attack of sudden sharp pain in the region of the umbilicus, with vomiting which continued for two days. Four days before entrance she began to have dull continuous pain just below the costal margin, followed by chills and sweating. The white count was 8800. She was in the hospital two days before operation, and grew distinctly worse during that time. There was very slight jaundice, noticeable only on careful examination, fulness through the right hypochondrium into the flank, with spasm and tenderness over the liver. There was nothing to call attention to the appendix except a distinctly local tenderness on deep pressure, without spasm, this had been overlooked by several previous examiners.

A diagnosis of portal phlebitis following appendicitis was made, and under ether the abdomen was opened over the right lobe of the liver, spasm persisting even under anæsthesia. On the upper surface of the right lobe there were three or four groups of small abscesses. These were incised, and the liver itself opened up freely with the director and finger, but no more abscesses could be found. The left lobe was normal in size.

Various punctures were made elsewhere in the liver without obtaining any more pus. Through a second abdominal opening a foul, stinking abscess cavity surrounding the appendix was opened and drained. Two days later the appendix wound was clean and sweet. Foul pus was escaping from the liver and the packing was removed without hæmorrhage.

On the third day, in the afternoon, the pulse suddenly rose to 160, the patient became unconscious, and, although stimulated with salt solution, etc., did not react. On the following day she was more or less delirious, with considerable discharge from the liver which seemed to be mostly bile, and five days after operation she died. No autopsy was obtained.

This can be taken as a typical example of a case seen and operated upon early. In more advanced or in atypical cases the grouping of symptoms is almost without limit, but, as a basis, we can almost always discover the definite history and signs of appendicitis, the fleeting jaundice, the hepatic pain, tenderness and enlargement, chills, and rapid emaciation.

To consider a few symptoms in detail. Jaundice is present in some degree in a majority of cases. It is frequently overlooked, as it may not exhibit itself elsewhere than in the sclera or urine. It is not often as pronounced as in cases of common duct stone. One of my cases, however, that I saw with Dr. Jackson, and which he has reported, had deep jaundice, but that is apt to be the exception. Of 80 cases reported individually within the last twenty years I find that in 34 there is definite mention of the presence of jaundice, while in 6 it is especially noted as being absent. Of the 40 in which no mention, one way or the other, is made, many of the clinical histories are very imperfect, so that it is safe to conclude that where the examinations are carefully carried out we will notice jaundice at some stage.

Chills are apt to be one of the earlier signals of the beginning portal infection. They may or may not be repeated, and rarely show enough regularity to make confusion in diagnosis with malaria justifiable.

Pain in the hypochondrium is important, and, according

to Abbadie and Reichardt, it is one of the most characteristic symptoms. It usually precedes the jaundice, or it may accompany it. With the pain we are apt to find attacks of vomiting, but the latter is not likely to persist, especially in the chronic type of case. In the acute cases it is sometimes persistent and intractable. Diarrhoea is not uncommon, but it is not necessarily present. Jourand reported a case ushered in by acute vomiting, intractable diarrhoea, and high fever, but the originating attack of appendicitis was probably responsible for this group of symptoms.

Soreness of the liver accounts for the stooping position that patients assume when walking, and for their lying on the right side with adduction of the thigh.

With the enlargement of the liver we may find an enlarged spleen, but it must not be confused with a left lobe irregularly swollen, nor must the tumor in the right hypochondrium be ascribed to swelling of the right lobe necessarily. Dyspnoea naturally is found with the swollen, tender liver.

Graham reports a case of suppurative gangrenous splenitis, originating in appendicitis, where, though there were no abscesses in the liver, the branches of the portal vein were full of pus.

The temperature, taken either hourly or twice daily, shows irregularity, and frequently makes wide excursions. This characteristic, together with a rapid pulse, should be a strong factor in ruling out typhoid even in the presence of a Widal reaction. The high pulse is often characteristically dicrotic. (Reichardt.)

The mental condition varies generally with the type of case. For the most part, since cases of this infection are more or less chronic, averaging from thirty to forty days (Abbadie), the sensorium is clear up to death, but in the acute types we must except somnolency, delirium, and coma. The comfortable mental condition of many of my own cases has been most impressive, suffering, except that from some extraneous cause, has been practically absent.

In a few cases we may expect hæmorrhages from the

different mucous membranes Distention of the superficial veins is occasionally seen, and in several of my cases there has been a local œdema of the parietes in the region of the hepatic foci

A friction rub can be occasionally heard over the dome of the liver, it is not pleural in origin, but is due to the rubbing together of the inflamed peritonitic surfaces The emaciation of the patient in chronic cases is very marked, and takes place in spite of voracious appetites and abundant feedings

In children, gastro-intestinal symptoms are manifest both at the outset and during the progress of the disease Convulsions, delirium, and other nervous phenomena are also found

Petechiæ and purpura are occasionally reported in severe cases The enlarged and thickened portal vein was felt once by Schoenlein as proven at autopsy We rarely find evidences of metastasis in distant organs to aid or obscure the diagnosis

The treatment in the various conditions considered here is surgical When the lymphangitis is limited to the tissues in the neighborhood of the cæcum or in the perirenal region, extraperitoneal openings may be made alongside the iliac crest or in the loin When the infection is in the subphrenic space, it may be attacked through the intercostal spaces, by resection of one or more ribs anteriorly or posteriorly, or by the lumbar route, as the case may require

Stone regards every delayed case of appendicitis with anxiety, and, when chills and other symptoms point to a complicating sepsis, he advocates treatment of the retroperitoneal space, and considers it as important as that of the intraperitoneal Were this done early in such suspicious cases, we would undoubtedly escape some of the direful accidents that follow the retroperitoneal infections

As a rule, it is best to attack the infections by the shortest route when that can be determined by swelling, local tenderness, X-ray examination, etc The trocar may be used for locating the pus, and retained as a guide for an immediate incision

In resecting a rib or ribs it makes little difference whether it is done anteriorly or posteriorly, so long as the indications point to one or the other route. The pleura, if it lies in the track of operation, may be stripped back, or sutured so as to prevent collapse of the lung and soiling of the pleural cavity, or it may be packed off with gauze and allowed to form adhesions and the diaphragm opened at a second operation. It is best to resect some rib below the eighth.

Anteriorly, Fox and Russell advise splitting the rectus at about its chondrocostal junction, exploring from this opening, and then, if a transpleural opening is required, resecting a portion of the rib through an incision extended backward along its convexity.

Lannelongue resects a triangular portion of the chest wall anteriorly and attacks the subphrenic area from this point.

To attack the intrahepatic collections of pus, one may make use of thoracic resection as in subphrenic abscess, or he may open up the abdomen freely and explore the liver under the guidance of sight and touch. By careful gauze packing there is little danger of peritoneal infection. Israel and others, in cases of pus collections situated in the outer posterior part of the right lobe, open alongside the twelfth rib, turning it and the kidney to one side, and incise the liver in the neighborhood of the renal depression.

To explore the liver itself, I much prefer two grooved directors. As soon as pus is located, the interior of the liver can be freely explored and broken up with the finger, all bleeding, even if it looks alarming for a few moments, is quickly stopped with gauze tamponade. The methods proposed for suturing the liver to the parietal peritoneum previous to exploration are difficult and useless.

In conclusion, I would make the following suggestions: first, lymphatic and hepatic infections are more common than we realize. Second, the two infections are frequently associated, and one type may be the source of origin of the other. Third, in certain cases of hepatic abscess, the source of infection, whether through the portal canals or through the

lymphatics, cannot be determined either clinically or at operation. Fourth, the type of infection does not depend upon the gravity of the originating appendicitis. Fifth, subphrenic infections must not be isolated in a class by themselves, as they depend on both lymphatic and hepatic infections, and *vice versa*. Sixth, hepatic infections are not uniformly distributed even when originating in the portal tract, the left lobe being solely affected at times. Seventh, the prognosis of lymphatic (including the subphrenic) infections is better than that of hepatic, but, when the latter are secondary to lymphatic or direct mechanical invasion, the outlook is more favorable than in the true portal invasions. Eighth, the most important clue in making a diagnosis is the recognition of the causative appendicitis, and the elimination of this possible cause is necessary in dealing with obscure hepatic invasions in the presence of plasmodia, the Widal reaction, etc. Ninth, early recognition and removal of the inflamed appendix may abort a secondary infection of the type considered here, but the corollary does not necessarily follow. Tenth, the characteristic signs and symptoms are well established in typical cases, and should form a basis for diagnosis in atypical cases.

## PAROTITIS FOLLOWING APPENDECTOMY

BY EDWARD BOWE, M D,

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IN the December, 1904, number of the ANNALS OF SURGERY, Brennan Dyball reviewed the literature and discussed the probable etiology and pathology of parotitis secondary to operative procedure upon the pelvic and abdominal viscera. Therefore, it is not the purpose of the writer of this paper to deal with this phase of the subject, except in comparing observations and arriving at conclusions from a study of the following two cases.

CASE I—H B, aged thirty-four years, occupation, teacher, family history negative, personal history, had the acute diseases of childhood (including acute parotitis), had an attack of appendicitis one year previous, was relieved by medical treatment, was admitted to Our Saviour's Hospital giving a history of an illness of twelve hours' duration, diagnosis, recurrent appendicitis. Operative procedure confirmed the diagnosis, the wound was closed without drainage, and the patient returned to bed in excellent condition. During the four days following the operation the patient's condition evidenced an uneventful recovery, but upon the fifth day he complained of pain in the region of the right parotid, examination revealed a slight swelling, which progressed, remaining confined to the parotid until the tenth day following the operation, when incision was made into the parotid and a quantity of pus evacuated, the wound was drained and allowed to close by granulation. At no time following the operation was there any indication of pus at the site of the abdominal wound. Patient was discharged cured at the end of five weeks.

CASE II—C C, aged twenty years, occupation, student, family history negative, personal history, had the acute diseases of childhood (including acute parotitis). Present illness was directly traceable to an injury received in a foot-ball game three weeks previous to being admitted to Our Saviour's Hospital. At



the time of injury, the patient was removed from the field, and for some time allowed to lie upon the ground exposed to the inclemency of the weather. Examination revealed tenderness and tympanites over the lower half of the abdomen, with marked tenderness at McBurney's point, a diagnosis of appendicitis was made and operative measures advised. My colleague, Dr J W Hairgrove, was called as a consultant and confirmed the diagnosis and, with my assistance, operated upon the patient. Immediately upon opening the abdomen, there was evidence of a diffuse inflammatory condition, the appendix was reached with great difficulty, the wound was drained, and the patient returned to bed in fair condition, the bowels moved freely twelve hours following the operation, and continued to do so until death, upon the fifth day. While there was marked evidence of peritonitis at the site of the wound, I am reasonably certain that it was localized and the drainage was adequate. During the third day following the operation, the patient became restless, complained of an intense thirst, and at intervals was slightly delirious. The abdominal wound was examined and found to be in a satisfactory condition. Four hours from this time, I was called, and found the patient in a most distressing condition. There was a marked increase in the pulse-rate, rapid respiration, a semidelirious restlessness, and in the region of the right parotid was a pronounced swelling, this swelling was not confined to the parotid, the adjacent tissues being early involved. The left parotid soon became involved in a similar manner, and from these foci of infection I have never seen a more rapidly extending inflammatory condition than followed, the tissues of the neck and face became rapidly involved, the patient assumed a most unsightly appearance, the symptoms of septicæmia became more and more pronounced, and death occurred early on the fifth day following the operation.

It is needless to consume space in discussing the theories and observations of others regarding secondary parotitis, Dyball has so recently and ably disposed of this part of the subject that I now wish to simply add my conclusions.

I believe parotitis secondary to traumatism or disease of the abdominal or pelvic viscera to be due to infectious material conveyed by the blood-stream from the primary focus of

infection to the parotid The locus minoris resistentiæ is explained by the fourth statement in the classification of reflex actions by Kuss "Those in which both centripetal and centrifugal nerves are of the sympathetic system, as, for example, the obscure actions which preside over the secretion of intestinal fluids, those which unite various generative functions and many pathological phenomena "

## ACUTE GANGRENOUS APPENDICITIS IN TYPHOID FEVER SIMULATING PERFORATION.<sup>1</sup>

BY JOHN H JOPSON, M D,

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Surgeon to the Presbyterian and Children's Hospitals

CARRIE C, aged twelve years, was admitted to the Medical Wards of the Presbyterian Hospital on March 6, 1905, under the care of Drs Musser and Talley Her history was as follows

Family history negative Previous medical history included a severe attack of diphtheria seven years ago For two years she has suffered with attacks of what were called "indigestion," which were accompanied by vomiting and severe abdominal pain lasting for from several days to a week, and of increasing severity In view of her subsequent history, their relation is of importance About the middle of January she was observed to be very languid, had no appetite, and complained of pain in the head and back, sometimes also in the abdomen She developed a cough, and the sputum was said to have been blood-tinged For several days before admission she had been quite ill

On admission her face was rather pale, tongue clean, lungs negative, heart, first sound not entirely clear, valvular sounds sharp, spleen palpable, a few rose spots on abdomen, abdomen soft, flat, and not tender Temperature,  $102^{\circ}$  F, respiration, 36, pulse, 112 Urine negative and normal

For the next few days the temperature ranged from  $100\frac{2}{5}^{\circ}$  to  $103\frac{3}{5}^{\circ}$  F, with marked daily remissions The diazo and Widal examinations were positive The treatment consisted of liquid diet, sponges, and hot mustard foot-baths for the control of fever Whiskey,  $\frac{5}{8}$  i q d, was added on the 9th of March So far the case had pursued the course of an ordinary typhoid of moderate severity Abdominal symptoms of severity had been absent There was no diarrhoea

On the 9th of March the temperature reached  $104\frac{4}{5}^{\circ}$  F at 11 P M, and then began to drop after a sponge At 5 P M of the

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<sup>1</sup> Read before the Philadelphia Academy of Surgery, May 1, 1905

## GANGRENOUS APPENDICITIS IN TYPHOID FEVER. 739

10th it was  $103^{\circ}$  F. Another sponge was given, bringing it down to  $101\frac{4}{5}^{\circ}$  F, and at 8 A M it was  $100\frac{3}{5}^{\circ}$  F, an assisted drop of  $4\frac{1}{5}$  degrees in nine hours. In the meantime, however, at 6 30 A M, she was suddenly seized by violent pain in the right side of the abdomen, extending from ribs to pelvis, and had a slight chill. The pain, which was paroxysmal, continued for about two hours, when she vomited, and had a bowel movement, after which she was more comfortable. The abdomen was not distended but slightly rigid, more so on the right than on the left side, and there was a point of marked tenderness in the right iliac fossa.

When seen at noon she was quiet, not complaining of spontaneous pain, tender over the abdomen on both sides, especially the right, with a rigidity also generalized, but most pronounced in the lower right quadrant, and increasing its area from hour to hour upward towards the costal region. At 11 A M the temperature was still as low as  $101^{\circ}$  F, respirations, 48, pulse, 156, but of fair volume and strength. The facial expression was good. A leucocyte count made on the 8th, two days previous, showed 3600. Four hours after the onset of the pain, the count was 10,800. A diagnosis of perforation of the intestine was made from what seemed fairly typical symptoms. The sudden onset of pain, the vomiting, the increasing abdominal tenderness and rigidity, with a rising leucocyte count, and rapid pulse seemed to warrant such diagnosis. The drop in temperature was not as rapid or as extensive as is often seen in perforation. Vomiting had ceased, and pain was not complained of except on examination. Peritonitis, however, was evidently spreading.

The patient was operated upon eight hours after onset of pain. Ether anæsthesia. Lateral incision, outer border of right rectus. Much free cloudy fluid in peritoneal cavity. The ileum was hooked out and rapidly gone over upward and back again for perforation, but none was found. Mesenteric glands much enlarged. The appendix was then brought into view, seen to be gangrenous in its distal portion, removed, and found to be perforated and containing a concretion. Free abdominal washing with salt solution brought much cloudy fluid from the pelvis. Tubular and gauze drainage was inserted in pelvis and loin space. The time of operation was twenty-five minutes, some time being lost in examining the ileum, and more consumed in careful washing.

At the conclusion of the operation the pulse was 180, but the patient soon reacted under free stimulation and hypodermoclysis. The temperature continued to decline until 4 A M of the following day, when it touched  $98^{\circ}$  F. Thereafter the surgical condition gave little anxiety. The wound did well, draining freely at first, later granulating slowly. Abdominal symptoms quickly ameliorated. The patient's general condition improved rapidly at first, and then continued typical of a typhoid infection. The temperature rose again and was  $102\frac{3}{8}^{\circ}$  F on the evening of the second day after operation, and then ranged between  $99^{\circ}$  and  $102^{\circ}$  F. The pulse continued good under free stimulation. On the 18th the temperature touched  $98\frac{3}{8}^{\circ}$  F, and then declined to normal more rapidly. Fourteen days after operation it became and remained normal.

The appendix when examined was found to be much inflamed, gangrenous for about two-fifths of its length in the distal portion, the mucous membrane inflamed throughout, and with a large concretion incarcerated in the gangrenous tip. At this point there was a small perforation. No typhoid ulcers of mucous membrane. Cultures gave abundant staphylococci.

The influence of typhoid fever on the appendix, and the occurrence of inflammations of that organ during and after typhoid fever, have attracted considerable attention, especially during the last few years, and it seems to be well recognized that the appendix often shares with the intestine in the pathological lesions, although in a varying degree. Among the pathological lesions noted are swelling and rigidity of the organ, congestion, peritoneal exudate of fibrinous character, infiltration with cells typical of the typhoid process, various lesions of the mucous membrane of an inflammatory or ulcerative nature, from simple swelling to superficial, deep, and perforating ulcerations, and complete necrosis. In addition to those cases of "typhoid appendicitis" in which such typhoid lesions are present, and in which the symptoms depend upon them alone, there seem to be one or more varieties of appendicitis which occur in the course of typhoid fever, in which the pathological process is practically identical with that observed in appendicitis occurring in the otherwise healthy individual. Kelly and Hurdon, in their book on the "Vermiform Ap-

pendix and its Diseases," have entered rather thoroughly into a study of the subject, and have attempted to classify the cases pathologically and clinically. In their pathological classification they make the following three types

1. Those in which the appendix participates in the typhoid lesions.

2. Those in which a secondary infection with pyogenic organisms is engrafted upon the typhoid infection

3. Those in which a simple appendicitis develops, the appendix not being involved in the typhoid infection, but in which it is probable that the attack is often precipitated by the congestion which accompanies it, without necessitating any specific typhoid lesions

As to the frequency of these lesions, they add that the appendix is involved in one-third of all cases of typhoid fever, and that of the perforative cases there is a perforation in the appendix in 5 per cent. (Some statistics give a little higher, others a lower percentage than this.) They believe that the second class, viz., that due to typhoid lesions, associated with a secondary infection, furnishes a large proportion of the cases of acute perforative appendicitis occurring in typhoid fever. As to the third type, they cannot estimate its frequency, but point out the deleterious influence which the hyperæmia attending the disease might be expected to exert upon a kinked, stenosed, chronically inflamed organ, perhaps containing a concretion.

The clinical classification which Kelly and Hurdon make differs a little from the pathological classification. It is as follows:

First group. Accidentally associated appendicitis, or a rousing into activity of a latent or chronic inflammation by typhoid fever

Second group. Appendicitis of mild or severe type arising from typhoid affection of the lymph-glands, or ulceration of the appendix

Third group. Appendicitis following typhoid fever within such a brief time as to suggest strongly a chance relation.

Kelly's and Hurdon's studies have apparently led them to the belief that the large majority of cases so far reported have been cases in which the typhoid process has been the main feature in exciting the appendiceal inflammation. They have encountered no case in a child where the appendicitis has developed in the course of typhoid fever. In our case, the history of recurring attacks of a painful type of so-called "indigestion" within the last year, the appearance of the appendix at operation, the presence of a concretion, and the results of the examination by the pathologist, make it very probable that it was one of the chronic or relapsing variety roused into activity by the hyperæmic and favoring conditions of the enteric attack, but not depending for its origin on any special typhoid lesion.

The question of diagnosis is of some interest. This case was mistakenly diagnosed as one of typhoid perforation. Perforation it was, but of another type, and which would presumably be associated with its own peculiar train of symptoms. We have already described the symptoms present, and mentioned one or two in which it differed in degree or kind from those typical of perforation. The condition, however, called for operation as strongly as if an anatomically and pathologically correct location of the lesion and its character had been arrived at, information desirable to obtain beforehand where possible, but of infinitely less importance here than the procedure for its relief. We believe that the rapidity of the process in this case is exceptional, even for appendicitis in a child, in whom we know by recent studies that the process is apt to be more rapid and more insidious than in adults. There is not usually much difficulty in distinguishing between appendicitis and perforation in typhoid fever, as Deaver emphasizes. As he states, the shock is not so great, the change in pulse-rate is not so rapid, the fall of temperature is infrequent, and the course when watched and not operated upon is not so rapidly to a fatal termination. In our case, there was a fall of temperature, but it came about the same time that the daily decline usually occurred, and it did not drop as suddenly nor go as low as the temperature usually does during

perforation, and hence, while it was pronounced enough to invite further study, it lent one of the few doubtful features to an otherwise apparently clear case of perforation. In every other respect the distinguishing features between the two conditions, as cited by Deaver, would have lamentably failed.

The advisability of operating for appendicitis during the course of typhoid fever is one which naturally has the keenest interest for the surgeon. We often hear it stated in discussions on typhoid perforation that laparotomy is well borne in typhoid fever. But certainly since, and possibly before, Maurice Richardson pointed out the difficulty of diagnosing between some atypical cases of typhoid fever, especially at the beginning of the attack, and some cases of appendicitis, and the humiliation involved in a needless operation for the one, as well as the dangers of a delayed operation in the other, and since the same distinguished surgeon has asserted the truth of the statement that operations in typhoid fever, even those of themselves comparatively slight, have a high mortality, we find some of our most radical surgeons emphasizing the necessity of caution in this field. In the early stages of the disease operation is nearly always successful, but even here it may form a complication which later on will seem to be unfortunate. Hence it is that we find Kelly advising a waiting policy unless the symptoms are exceedingly urgent; Murphy counselling against operation unless perforation has taken place, and Deaver, in his latest word on the subject, saying that, while in the early stages the result of operation is nearly always favorable, later the operation may be a serious complication, and even cause a fatal result. Hence he favors temporizing where possible where appendiceal inflammation develops after the third week is under way, and operation after recovery from the fever. Deaver strongly advises against operating during the height of the disease, except for pus or perforation, and quotes Harte's and Ashhurst's statistics of operation for typhoid appendicitis. Of twenty-six cases which they collected, seven died, the mortality being heaviest from the second week onward.



# JABOULAY'S ANASTOMOTIC BUTTON.<sup>1</sup>

## AN EXPERIMENTAL STUDY

BY EDWIN BEER, M D,

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THE purpose which I had in view when I undertook the following study was to ascertain whether the new anastomotic button, designed by Jaboulay, Professor of Surgery in Lyons, was superior to other mechanical contrivances at present employed. The opinion of the Lyons clinic was very naturally highly favorable, and Jaboulay and his assistant, Gayet, speak of the new button with unstinted praise.

At the present time surgeons are more and more of the opinion that an anastomosis made by suture is preferable to one made by any mechanical contrivance. Still, there are cases when, to save time, to prevent shock, etc., the greater safety and reliability of the suture method must give way to the use of the mechanical contrivance. Up to the present time, the only contrivance which has been universally approved of, and which has become a favorite and necessary part of every surgical equipment, is the button invented by Murphy. Jaboulay's button is to displace the button of Murphy, and in the following pages I naturally will have to compare these buttons and their relative advantages rather than enter into any comparison between the well-accepted methods of anastomosis by suture and the anastomosis that can be effected by the new button of Jaboulay.

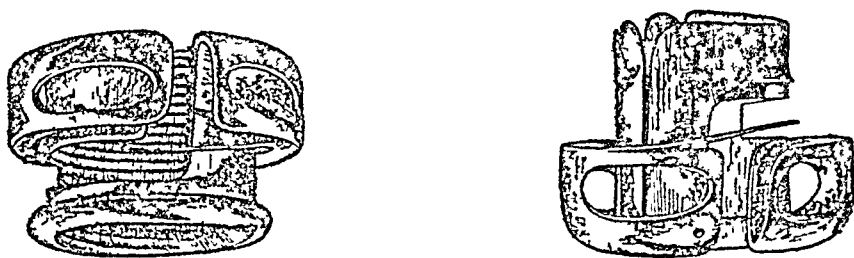
Some years have elapsed since the new button was described. In construction it resembles superficially the button of Murphy, but its principle is quite different. Instead of introducing each half of the button through an opening in

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<sup>1</sup> From the Surgical Laboratory of the College of Physicians and Surgeons, Columbia University

the bowel, proportionate to the largest diameter of the button, and then closing the incision to either side of the inner cylinder of the button by suture, *Jaboulay thought he could make use of the screw and key-ring principle and introduce the halves of his button through a very small opening, thus avoiding all use of sutures* A button introduced in this way naturally would be placed *in situ* very much more rapidly than a Murphy button

To understand the mechanism of the new button, I must describe its peculiarities For purpose of description, I shall take the button of 22 millimetres diameter As seen in the



illustration, the button consists of two halves, a male and a female Each half is made up of two cylinders, an outer and an inner The outer is perforated with drainage holes just as in the Murphy button, though the openings are of a different contour At one point in the outer cylinder there is a distinct break in the continuity of this cylinder, this gap or slit is prolonged into the inner cylinder and continues almost half-way round the inner cylinder It measures in a 22-millimetre size button approximately one-eighth the diameter of the button It is vertical in the outer cylinder, running through its entire thickness; whereas in the inner cylinder it at first is vertical, corresponding to the slit in the outer cylinder, but very shortly bends at right angles and runs, as said above, almost half the way around the inner cylinder In this slit the Jaboulay idea is concentrated By means of this slit the button can be introduced into the lumen of the bowel through a small opening Naturally, the same slit arrangement is present in the male and female halves of the button, and these

fasten into each other by means of a screw-thread arrangement somewhat similar to the mechanism of the Murphy button. As the outer cylinder has been interrupted by the slit which runs through it, to obtain approximation of the two pieces of bowel at this point when the buttons are driven home, Jaboulay had to prolong the mesial margins of the outer cylinder, *i e*, the margins which come into contact with each other when the buttons are approximated, otherwise there would be leakage at this point. The prolongation of this margin is in the form of a thin, elongated metal plate, which acts like a weak spring in closing the slit in the upper or mesial border of the cylinder. The extra cylinder of the Murphy button, which works on a spring and whose function is to force and hold the two apposed serosa surfaces against each other and eventually produce their necrosis, is not used in the Jaboulay button. In this button the apposition and subsequent necrosis are produced by the operator's forcing the two halves of the button very firmly together.

The technique of introducing the button as described by Gayet is as follows.

To introduce a button whose largest diameter is 22 millimetres, an incision into the bowel 1 centimetre in length is required. The half of the button held by the inner cylinder by a clamp is brought to the incision, and the lip of the slit in the outer cylinder is introduced into the lumen of the bowel by a screw motion. At first the long diameter of the outer cylinder of the button is perpendicular to the opening of the bowel, and to the surface of the bowel, gradually, however, the above diameter is made more and more nearly parallel to the surface of the bowel, and the button is screwed into place, the entire outer cylinder entering the lumen of the bowel. The button is securely held in place, primarily because the small opening in the bowel fits its inner cylinder snugly, secondarily, by the fact that the lip of the incision in the bowel prolapses into the slit which runs about half the way around the inner cylinder. After placing each half of the button *in situ*, the two parts are driven home with considerable force to make

sure there is no chance of leakage, and that the button will cut through and free itself by producing the necessary necrosis

Jaboulay has used his button 200 times in intestinal, gastric, and gall-bladder operations. On the whole, he is very well satisfied with it. He claims that he can introduce it much more quickly than the Murphy button. Recently (*Centralblatt für Chirurgie*, 1904, p. 1195) he said that in favorable cases he can make an anastomosis in two minutes. He claims, also, that with perfect buttons the results are excellent and the procedure is perfectly safe.

Two questions naturally suggest themselves at this point. Can the button really be screwed into the bowel through a small incision? Does the button cut its way out of the anastomosis? To answer these most important questions, I undertook the following experiments after procuring six of the Jaboulay buttons from Lyons.

Before giving my results, however, let me see if we can find any answers to the above questions in the publications of Jaboulay and Gayet. Both declare that a button of the size above described can readily be introduced through a 1 centimetre incision, if the above directions are carefully followed. The gradual change in the relation between the diameter of the button and the surface of the bowel as the button is screwed into place, Gayet thinks the essential factor in introducing the button without tearing the incision. Still, if we scan carefully the incomplete reports of the few cases in his paper, we see that in Case 31 operated by Jaboulay there was a tear one-half inch long which required a suture, in Case 78 operated by Gayet there was a similar tear. How frequently the above surgeons produced tears, I cannot tell from these reports. Still, it is evident that the button, even in their hands, cannot regularly be screwed into place without tearing the bowel, and necessitating sutures.

In the fourteen anastomoses that I made in dogs I found that, though the button was easily screwed into place, I very frequently produced tears which, as far as I could see at the time of operation, involved only the serosa. In fourteen an-

astomoses I naturally used twenty-eight pieces of bowel and introduced twenty-eight halves of the buttons. In eighteen of these I tore the incision in screwing the button into place. All of these required one or more silk sutures to close the rent. In no instance, however, did the mucosa prolapse through these tears, as it does through the larger incision used in the introduction of the Murphy button.

I said above that at operation these tears apparently involved the serosa alone, but later on I shall call attention to a fact found at autopsy which forces me to conclude that the other layers of the bowel are torn more or less frequently.

*These data go to show that the introduction of the Jaboulay button without producing lacerations requiring suture is by no means a regular procedure. In view of the fact that the purpose of this button is to avoid all suturing, it is evident that it does not meet the demand.*

A careful examination of the button will readily explain why the introduction of the button is liable to tear the incision in the gut, for the tears, as will be seen, are actually caused by stretching and divulsion of the small incision. If the button is followed as it is screwed into the bowel, one notes that at first it screws in very readily, but as soon as half of the outer cylinder is in place a distinct resistance is encountered. The slit in the outer and inner cylinders which runs not quite half-way round the inner cylinder permits the ready introduction of the corresponding half of the outer cylinder. However, as soon as the end of the slit in the inner cylinder is reached the incision in the bowel is held fast at that point, and the incision itself is stretched to permit the outer cylinder to enter the bowel. This stretching must accommodate more than the largest diameter of the button that is still outside of the lumen. The stretching must equal in length the distance from the end of the slit in the inner cylinder around this cylinder to the tip of the spring-like plate which serves as the prolongation of the mesial surface of the outer cylinder, for the incision does not accommodate diameters, it is forced by the construction of the button to accommodate circumferences.

The distance measured from the end of the slit around the inner cylinder to the end of the plate-like prolongation on the mesial rim of the outer cylinder in a 22-millimetre button is approximately 33 millimetres. Thus the original 1 centimetre incision in the bowel is stretched to over 3 centimetres to permit the introduction of the button. This excessive stretching naturally tears the wall of the bowel and defeats in this way the very purpose of the button.

In dogs, in eighteen out of twenty-eight instances, the button's introduction produced serosa tears. Whether in the other ten cases tears were produced below the serosa I cannot say, though, judging from the behavior of the other coats of the intestine when the bowel is overstretched by distention, one might be inclined to deny tears in these cases. Jaboulay's and Gayet's cases mentioned above show that similar tears occur in the human bowel, and such was to be expected, seeing how the construction of the button has really defeated the purpose of the inventor.

Are these tears a great drawback and danger? In my cases I saw no bad result from them, though theoretically everybody will picture to himself serious possibilities, which these tears carry with them, especially when one realizes that the button may remain *in situ* indefinitely. From the few cases reported in some detail by Jaboulay and Gayet, I was unable to detect any serious results that were attributed to these tears. They had 18 per cent mortality in their series of gastro-enterostomies for carcinoma ventriculi, and of the eighteen deaths four were due to peritonitis,—two of these were due to leakage from the button and two were due to some cause which they omitted to mention. Possibly the divulsion of the incision had some relation to some of their peritonitis cases!

From the above remark, it will be clear that the button is liable to tear the small incision, even though that is not a regular event. If the button could be regularly introduced into the human bowel without tearing the wall of the bowel, a feat which I fear is very improbable in view of the construc-

tion of the button, it would mark a decided advance over the Murphy button as far as the question of the introduction of the button is concerned, for then not only could the button be placed *in situ* more rapidly, but no sutures would be required, and the danger of soiling the peritoneum would be reduced to a minimum, for the button, while being screwed into the bowel, acts as a plug, closing the incision completely. Even as it is, despite the tears produced, the button is in some respects superior to the Murphy button, always considered from the stand-point above taken, that of the introduction of the button. In other points it is inferior to the Murphy button, and consequently, in my opinion, will never displace the older contrivance except in individual cases where greater rapidity of work is absolutely essential. It is much more quickly introduced into the bowel, and the operator is never troubled by the prolapsing mucosa which is often so annoying when the Murphy button is used. Another advantage over the Murphy button is the fact that the button is held more firmly in the incision by the walls of the gut, and the operator need not rely on sutures to grasp the button. These distinct advantages of the button are, however, outweighed by the disadvantages which will be discussed in answering the second question propounded above.

Does the button cut its way out of the anastomosis? I said above that the force that drives the Jaboulay button home is the effective element in producing the necrosis of the gut that intervenes between the outer cylinders, and thus the liberation of the button. The force used naturally must be fairly great, but even when I pressed as firmly as I could, with cotton sponges as buffers between the gut and my fingers, the button was not regularly eliminated. The pressure that was necessarily employed at times produced small hæmatomata in the wall of the gut. I say necessarily, because, prior to exerting this excessive pressure, I found that, on testing the anastomosis by forcing the gastric contents through the button into the temporarily obstructed gut, an escape of gas bubbles at the anastomosis became evident. From such a leakage Jaboulay lost two patients.

In this pressure, which is necessary both to prevent leakage and to produce the necrosis prior to the passage of the button, I find one of the disadvantages of Jaboulay's button. Murphy met this difficulty by the use of the third cylinder in the male button, which works on a firm spring, obtaining both complete apposition and the necessary necrosis without use of any great pressure by the operator.

As might be expected, in view of the fact that the elimination of the Jaboulay button depends entirely on the amount of pressure exerted in driving the buttons home, the button frequently remains *in situ*, carrying with it dangers of ulceration and obstruction, etc.

In Gayet's recent paper he says, "in a very large number of the cases the button is not passed, either remaining *in situ* or falling into the stomach." (*Revue de Chirurgie*, page 474, 1904.)

Jaboulay's recent statements are less direct on this point, so that I cannot ascertain whether the button remains in the anastomosis most of the time or not. He says in one-third of the cases the button remains in the stomach. How many are free and how many firmly fixed, he does not say.

In my cases, of which twelve anastomoses were available for this purpose, eight out of the twelve buttons were passed. In these, one-third of the buttons remained in the anastomosis. Autopsy showed me why the buttons remained *in situ*. Two factors contributed to fixing the button in the anastomosis. Either insufficient tissue between the outer cylinders had been cut out by necrosis or the drainage holes had been filled with masses of thickened mucosa, which frequently ran into one such hole and out of the next one, making a loop from gastric wall to gastric wall through the button. The insufficient necrosis was occasioned by insufficient pressure, though I employed practically all the strength that I could bring to bear with thumbs and fingers of both hands. The entanglement of the mucous membrane in the drainage holes, I can explain in only one way, namely, by assuming that the mucosa was torn when the button was originally introduced, and that these



shreds of mucosa prolapsed into the drainage holes and united with one another, firmly fixing the button in its place. This peculiar behavior of the mucosa explains what I referred to above when I said that, though the tears apparently were only peritoneal, at autopsy other features showed that deeper tears, tears of the other layers of the intestine, were also produced.

From the foregoing remarks it will be apparent that the new button has the advantage of being easily and very rapidly introduced, without making a large incision in the bowel. That, on the other hand, it has the disadvantages that it divulses and tears the incision, that its halves must be driven home with great force, and that it frequently becomes firmly fixed in the anastomosis and is not eliminated.

A button to be of great use should have no such bad features, especially if it is to displace the methods of anastomosis by suture, or that by means of the Murphy button, as Gayet expects the new button to do.\* I believe that Jaboulay's button will never displace these methods, in fact, never rival Murphy's button, much less the method by suture, in the general run of gastro-intestinal work.

In one class of cases, however, where its advantages are of importance and its disadvantages of little consequence, the new button may prove of great service. In advanced carcinoma cases, especially in very feeble cases of gastric cancer, the saving of time by the use of the Jaboulay button may be life prolonging, while the fact that it may not be passed is of little or no consequence. To emphasize its usefulness in this field in this type of cases, Gayet reports only 79 per cent mortality in the last forty-one cases of gastro-enterostomy for carcinoma ventriculi. In cases where rapidity of operating is less essential, I cannot see any justification for using the new contrivance.

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\* Gayet says, (op cit, p 10,) "Terrier, Hartman, etc, have declared themselves well satisfied with the suture method, which is readily understood, seeing that they have used the buttons of Murphy and of Villard"

## EXPERIMENTS

EXPERIMENT I—March 22, 1905 Male dog, medium size Posterior gastroduodenostomy and anterior gastrogastrostomy Median two-inch incision in epigastrium, stomach and duodenum drawn into the wound Smallest button (No 1) employed for anastomosis Incision into stomach and duodenum about one-third diameter of the button Button easily introduced without tears and firmly driven home Pressure or serosa near union requiring a suture Anastomosis completed in two and a half minutes Then an anterior gastrogastrostomy was done with button No 2 The incision was about one-third the size of the button's largest diameter Introduction of button tore the serosa, requiring several sutures Button driven firmly home Anastomosis in three minutes Abdominal wall closed

April 7 Button No 1 passed

April 12 Autopsy Button in gastrogastrostomy union firmly held *in situ* Both anastomoses very firm and satisfactory

EXPERIMENT II—March 24, 1905 Male dog, medium size Posterior gastroduodenostomy and anterior gastrogastrostomy Same technique as in Experiment I Button No 1 in posterior gastroduodenostomy Introduction of the button tore the serosa on the duodenum, requiring a suture Anastomosis, without rushing, in two minutes forty seconds Button No 2 in gastrogastrostomy, no peritoneal tears Anastomosis in three minutes fifteen seconds

Neither button was passed, autopsy about three weeks later showed excellent anastomosis Button No 1 was free in the stomach Button No 2 was almost free, though attached from one-third to one-half inch of its circumference by a tongue of mucosa that held it firmly, by becoming entangled in the drainage holes

EXPERIMENT III—March 29, 1905 Male dog, large Posterior gastroduodenostomy and anterior gastrogastrostomy Same technique Jaboulay's button No 3 Twenty-two millimetres button used in both anastomoses Introduction of the four halves led three times to tears which required suture. Unions were tested for leakage by forcing bowel gas, etc, through the anastomoses and obstructing exit into bowel beyond Apparently no leakage During operation pancreas was injured and considerable hæmorrhage ensued

*Autopsy*—Dog died within twenty hours of operation Abdomen contained considerable blood Here and there flakes of fibrin, especially near the gastrogastrostomy anastomosis, where the button had separated Examination of this button later showed that the two halves could be readily drawn apart by traction The button was defective\*

EXPERIMENT IV—April 12, 1905 Male dog, medium size Posterior gastroduodenostomy and entero-anastomosis Identical technique But-

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\* Jaboulay had similar experiences The buttons can be readily tested before use by simply drawing on the two halves after they have been driven home If the button separates, it is imperfect and not to be used

ton size No 2 used in posterior gastroduodenostomy, size No 1 in the entero-anastomosis. Introduction of each half button very easily accomplished, but each and every time the serosa tore.

April 19 Button No 1 passed

A week or so later autopsy showed the other button *in situ*. There was no necrosis between the halves of the button. In addition, loops of mucous membrane ran through the drainage holes of the outer cylinder and firmly fixed the button.

EXPERIMENT V—April, 1905 Male dog, medium size. Posterior gastrogastrostomy and duodeno-ileostomy. Button No 2 used in the former, No 1 in the latter operation. Technique similar to previous operations. Tear in stomach and tear in ileum. April 25 Button No 1 passed.

May 10 Autopsy. Button No 2 *in situ*. No necrosis of tissue between its halves. Mucous membrane prolapsed into drainage holes, firmly fixing button in its position.

EXPERIMENT VI—April 26, 1905 Male dog, medium size. Posterior gastroduodenostomy and entero-anastomosis. Same technique. In both anastomoses button No 1 used. Introduction causes two serosa tears.

May 2 Both buttons passed

May 10 Autopsy showed excellent anastomosis

EXPERIMENT VII—Female dog, medium size. Posterior gastroduodenostomy and ileoduodenostomy. Same technique. Button No 1 used in each anastomosis. Three tears produced by introduction of the three halves of the buttons. On driving the buttons home, the pressure exerted caused another serosa tear.

May 23 One button passed

May 25 Second button passed

*Epicrisis*—In all, fourteen anastomoses were made. In no case was a reinforcing circular Lembert suture used. Perhaps such a suture might have prevented leakage in Experiment III. Jaboulay does not use a reinforcing suture, claiming it is unnecessary. If it is employed, the union is undoubtedly strengthened, and accidents, such as leakage, are prevented. Jaboulay lost two cases due to leakage. In introducing the halves of the button tears were made eighteen times. Of the fourteen buttons only eight cut their way out of the anastomosis. The eight buttons were all the smallest size button (No 1). Why the larger buttons failed to cut their way out while the smallest size was regularly passed, I cannot understand, unless it be due to the fact that the larger the button the greater the tear in the coats of the intestine or stomach, and, as we have seen, these subserosal tears are very liable to fix the button firmly *in situ*.

# TUBERCULAR PERITONITIS IN WOMAN.<sup>1</sup>

BY HENRY O. MARCY, M D,

OF BOSTON, MASS

THIS comparatively rare disease is brought to the attention of the Congress since it offers an interesting field of observation, of profit for the prevention of tuberculosis, and each of the later years is adding cumulative evidence of cure by surgical intervention in a large percentage of the cases operated upon

Inasmuch as the tubercular infection of the peritoneum has its invasion chiefly through the reproductive organs, it adds one more reason why the pelvic structures of woman should be maintained, as far as possible, in normal condition. A lacerated cervix, a chronic endometritis, a diseased Fallopian tube may make an easy admission for bacillary infection. Therefore restoration to normal conditions often serves the first purpose of preventive supervision.

The disease having been established, and diagnosis determined upon, the weight of evidence is strongly in favor of operative intervention, although the rationale is little understood. Excellent results have followed simple exploration even in advanced cases.

In 1885, I operated upon a young woman of twenty-seven years, unmarried, with a history of some months of suffering, anæmia, loss of flesh, slight abdominal distention from fluid, pelvic pain, preceded by irregular and painful menstruation.

The diagnosis of enlargement of the Fallopian tubes with fixation of the uterus and pelvic tenderness was easily made. Laparotomy was performed for the purpose of removing the appendages.

We were surprised to find a miliary tuberculosis thickly studding the abdominal peritoneum, the omentum and intes-

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<sup>1</sup> Read before the American Antituberculosis League, April 18, 1905

tines Very considerable masses partially filled the pelvis We sponged out the fluid and closed the abdominal cavity without drainage, giving a most unfavorable prognosis

The convalescence was easy and rapid, and at the end of about four weeks she left the hospital in every way better than upon admission The conditions at that time, from the surgical stand-point, were altogether new, and we watched her history with exceptional interest She continued slowly and steadily to improve, and when last heard from, two years later, she wrote me, when on a visit to Europe, that she was in fair health, although there was not a complete restoration to her former vigor Bacteriological examination confirmed the correctness of the diagnosis

Somewhat later, in another woman, I opened the abdomen for the purpose of removing a large uterine myoma, and was equally surprised to find a widely disseminated miliary tuberculosis, so extensive that I abandoned the further operative interference, contenting myself with a careful sponging of the peritoneum with a strong solution of the bichloride of mercury Here, also, the recovery was easy and rapid, and the patient has continued in fair general health with a marked lessening of the tumor When last heard from, somewhat recently, her physician reported to me that she was in active discharge of her ordinary household duties

The experiences of the years have added a very considerable number of somewhat similar cases I find that little by little I have instituted a much more active intervention without being able to give an exact reason

I sponge the peritoneal cavity very carefully for the removal of all fluids, and apply by sponging with care a solution of bichloride of mercury, 1-1000, to the entire peritoneum

I use very freely afterwards normal salt solution, again drying the cavity carefully, blowing iodoform to disseminate it lightly but thoroughly over all the organs, and close without drainage

I have occasionally varied the technique by filling the peritoneal cavity with hot normal salt solution and leaving it

Thus far I have not had a single fatal result from operation. One patient died in about six months, evidently from a return of the disease. Perhaps two years is a minimum period in which to consider the cure complete, although the time limit must necessarily be a purely relative one.

A brief history of the last case within this limit is interesting.

Miss T, aged thirty-eight years. Always well except painful menstruation. Sudden invasion of abdominal pain occurred January 15, which was very severe. This was followed about a week later by a bloated feeling, and upon admission to hospital, February 22, 1903, the abdomen was distended more than twice its normal size. Diagnosis of probable tubercular peritonitis had been made.

Laparotomy performed, several pints of bloody serum removed. There was a thick exudate, partly filling the pelvic cavity, producing fixation of the reproductive organs. Minute tubercular nodules were widely disseminated upon the abdominal walls, omentum, and intestines.

The extent of the disease caused the making of an unfavorable prognosis. Convalescence, however, was uneventful and rapid, and at this date she appears to be thoroughly well.

It is generally accepted that the *Bacillus tuberculosis* enters the abdominal cavity, in woman, much more commonly through the Fallopian tube. This would not be expected when the tube is in a normal condition, as the ciliated epithelium deflects the passage of its contents towards the uterus.

For the same reason, the *Bacillus tuberculosis* rarely invades the pulmonary structures until the ciliated epithelium which line the bronchi are impaired in function or destroyed.

In the more recent period, peritoneal infections afford a subject for study of intense interest. It is invaded by the surgeon with a temerity hitherto undreamed of, and its maintenance in an aseptic condition is one of the most noteworthy victories of modern science. The peritoneal cavity may be considered as one enormous lymph sac.

When an infection occurs, one of nature's battles royal takes place. The abdomen provides an ideal culture chamber, heat point, albuminoids for food in abundance, conditions most favorable for development. It is interesting to note the extraordinary differences dependent upon the character of the implanted enemy. I have known a streptococcal infection prove fatal in sixty hours from its first invasion. In one instance, a supposed healthy woman felt something give away upon stepping into a high car. Death supervened in only a little over two days. The autopsy showed pints of flocculent fluid in the abdominal cavity. The infection arose from a cyst of the pelvis scarcely larger than a walnut, there was oozing from a small opening a dark, thick fluid. Cultures were made from both, demonstrating the identity of the infection.

The gonococcal infection of the Fallopian tube is a not seldom cause of a fatal peritonitis.

It is a matter of general knowledge that the *Bacillus tuberculosis* reproduces, in comparison with other forms of infection, exceedingly slowly.

This is why the "great white plague" has not swept the earth of the last inhabitant, and the knowledge of this slow reproduction gives most hopeful prospect for its prevention and cure.

If the rapidly multiplying hosts do not give opportunity for the obstruction of the lymph channels by nature's flying cohorts of leucocytes, the battle is soon over. In the slowly multiplying organisms of tuberculosis the picture is entirely different. The lymph channels are obstructed, the segregated colonies which have invaded them are surrounded by white cells imprisoned, and are often destroyed by their phagocytic action.

The fluid, usually a concomitant factor in advanced peritoneal tuberculosis, is in large measure a transudation from the capillary net-work of vessels, and in its escape lifts the endothelial cells lining the peritoneum. These cells, with leucocytes, float in the blood serum, and give to the fluid its flocculent character.

This albuminous fluid furnishes abundant bacterial food, and at the same time most seriously interferes with normal phagocytic action. In the removal of this fluid we find one important reason why surgical intervention is of value. Here the omentum, with its vast net-work of vessels, is a most important ally. Because of the anatomical construction, the power of absorption varies greatly in different parts of the peritoneal cavity.

In the diaphragmatic region, the lymph tracts and stomata are large, in the intestinal region of less size. In the pelvic region absorption takes place much more slowly.

It is rich in capillary lymphatics, but has few large lymph vessels. These small vessels are easily blocked by leucocytes, and a bacterial invasion is thereby more easily limited.

Such facts are of the first importance in aiding us in inferential deductions as to the benefit derived from operative interference. First, the removal of the fluid, second, the stimulating effect of exposure of the peritoneal surfaces to the air, the mechanic irritation of sponging, the chemic effect of medicamenta, *e g*, mercuric solutions, iodoform, etc. All such measures greatly increase the leucocytes, upon which it is very probable the destruction of the bacteria and the resultant cure depends.

Arangelí (Thesis Breslau) advanced the theory that the serous exudation following operation possesses powerful immunizing qualities of curative value arising from dead bacteria. He claimed to show advantageous results from the injection of ascitic and pleural effusions. The inference was easily drawn from the advantageous use of antidiphtheritic and other serums.

Ebstein (*Boston Medical and Surgical Journal*, December 13, 1900) collected the histories of 227 cases of tubercular peritonitis where operation was performed. His conclusions are that the simple opening of the peritoneum is the one factor of value. He reports 15 cases from the Breslau Clinic of apparent cure.



Bottomly (*American Medicine*, January 31, 1903), of Boston, reports and analyzes 28 cases operated on. He concludes that cures may reasonably be expected in 30 per cent to 40 per cent of all cases.

A. E. Halstead writes very carefully upon tubercular peritonitis, dividing it, from a clinical stand-point, into two heads, cases in which ascites is predominant and those in which tumor formation is the marked feature.

Diagnosis usually difficult. History of antecedent disease important. The patient should not be considered cured until five years have lapsed after operation.

He states over 1500 cases treated by laparotomy have been recorded. In the ascitic form of the disease, the operative treatment can be conservatively stated as giving 40 per cent to 50 per cent of definite cures.

The surgeon has by his intervention made a most valuable contribution towards the prevention, limitation, and cure of one phase of the most wide-spread and deadliest enemy of mankind.





Dr Wyeth's case of fracture at the base of the first phalanx of the ring-finger

## FRACTURE OF A PHALANX NEAR THE EPIPHYSIS.

BY JOHN ALLAN WYETH, M.D.,

OF NEW YORK

Professor of Surgery in the New York Polyclinic

A GIRL twelve years old presented herself at my surgical clinic at the New York Polyclinic Medical School and Hospital with a history of having fallen six weeks before and hurt her left hand

The radiograph made by Dr Milton Franklin shows the deformity due to a very unique fracture of the first phalanx of the ring-finger. It will be observed that there was no separation at the epiphysis, the fracture occurring beyond this point, leaving a thin film of bone on the epiphyseal side. There was marked displacement of the phalanx towards the middle finger with union in this false position.

Three days later the girl was anæsthetized, and an incision made over the point of fracture on the side of the finger nearest the middle finger. A refracture was made, some intervening soft tissues dissected out, and the phalanx carried into its normal position, with subsequent union without deformity.

# AS TO THE NECESSITY OF CONSENT TO RENDER SURGICAL OPERATIONS LAWFUL.

BY JOHN FRANKLIN SHIELDS, ESQ.,

OF PHILADELPHIA

THE purpose of this discussion is to state the law as it appears to be, but we also wish it to be understood that to relieve the surgeon of annoyance, litigation, and expense, full and clear consent should be had in all cases whenever possible

Only four decisions directly on the subject of this opinion have, up to the present time, been rendered by Courts of the last resort within English or American jurisdiction

They are *McClallen vs Adams*, 19 *Pickering* (Mass ), 333 *State vs Housekeeper*, 70 *Maryland*, 162 *Pratt vs Davis*, Appellate Court of Illinois, February, 1905 *Beatty vs Collingworth* (an English case), *Central Law Journal*, vol xlv, page 153

Herein we will simply refer to these cases without quoting the reports

The operation in each of the cases above referred to, while believed advisable by the surgeon in each instance, does not appear to have been performed in cases demanding immediate operation as the only chance to save life The opinion rendered in *Pratt vs Davis* is the most recent and by far the most exhaustive opinion of the four, and recognizes the other three cases as authorities

It will be of material aid in securing a clear analysis of this subject to divide the requirements for a surgical operation into two classes

FIRST THOSE WHERE A SURGICAL OPERATION IS ADVISABLE, BUT AN IMMEDIATE OPERATION IS NOT IMPERATIVE TO SAVE OR PROLONG LIFE

SECOND THOSE WHERE AN IMMEDIATE OPERATION IS NECESSARY AS THE ONLY COURSE OF TREATMENT KNOWN WHICH MAY SAVE OR PROLONG THE PATIENT'S LIFE

Consent may be express or implied. That consent will be implied where one places himself in the hands of a physician or surgeon and submits to an operation is the law set forth in all the cases above mentioned

#### A AS TO THE CONSENT OF AN ADULT

*In the cases where operations are advisable but an immediate operation is not imperative to save or prolong life*, the consent of the patient is required, and is sufficient to make the operation lawful, and the operator is not liable for any error of judgment, provided he has exercised that care and skill which the law requires *Pratt vs Davis*, Supra, *State vs Housekeeper*, Supra, *McClallen vs Adams*, Supra, *State vs Gile*, 8 Wash, 12, *Comm vs Pierce*, 138 Mass, 165

“Under a free government at least the free citizen’s first and greatest right, which underlies all others,—the right to the inviolability of his person, in other words, the right to himself,—is the subject of universal acquiescence, and this right necessarily forbids a surgeon or physician, however skilful or eminent, who has been asked to examine, diagnose, advise, and prescribe, to violate without permission the bodily integrity of his patient, by a major or capital operation, placing him under an anæsthetic for that purpose and operating on him without his consent” *Pratt vs Davis*, Supra

The Court in stating the above had the facts of the particular case in mind which was before the Court, as elsewhere in the same opinion the Court said

“Perhaps, too, the various cases which might be supposed of sudden and critical emergency in which the surgeon would be held justified in a major or capital operation, without express consent of the patient, might be referred to the principle of implied license” *Pratt vs Davis*, Supra

*If the patient be a wife*, her consent to the operation is all that is necessary (provided the wife be compos mentis) It is prudent to notify the husband, but it is not necessary Even if he refuses consent, the consent of the wife is sufficient *McClallen vs Adams*, Supra, *State vs Housekeeper*, Supra

*If the patient is non compos mentis*, hence incapable of consenting, it would appear that the consent of the person (or persons) in control over the person of the lunatic is necessary. There must be no doubt of the patient being incapable of consent. The surgeon's opinion is not sufficient. A judicial inquiry, first determining the patient's insanity, would relieve the surgeon of liability of operating without consent if the patient afterwards brought action against him. *Pratt vs Davis, Supra*. The surgeon should also satisfy himself as to parties legally in control of the person. *Pratt vs Davis, Supra*. In the case of an insane wife, the consent of the husband might not be sufficient, for the same reason that a husband cannot restrain the liberty of his wife on the ground of insanity, without having an inquiry judicially made and her insanity legally declared. *Pratt vs Davis, Supra*.

*In the second class of operations*, to wit, *where an immediate operation is imperative as the only chance to save or prolong the patient's life, and hence that death would certainly and positively result without the operation*, the consent of the patient, when an adult, would of course be sufficient, as in the first class of operations, to make it lawful.

"And even if the disease resulting in the patient's death is caused by the operation, the surgeon is not liable if he performed the operation with the patient's consent, and under the belief that the operation was proper to be performed" *State vs Housekeeper, Supra*.

However, in such positive life and death cases, the question naturally arises, Would an operation be lawful against the will of the patient? It is quite unlikely that such a case will ever arise, as it would be a rare case indeed where a surgeon would operate at such a time. The danger and risk to a surgeon of an action at law under such a set of facts, is the difficulty which would likely arise in getting the evidence and facts so that the jury, and also the Court, would be convinced that the operation was the only course of treatment to be pursued, that the said operation did not cause the death or did cause the recovery of the patient. The plaintiff gen-

erally can secure some other physician who honestly, or dishonestly, will be found to disagree with the surgeon's diagnosis, prognosis, or mode of treatment

Further, it would appear that *a surgeon operating against the will of a patient would be liable for any error of judgment, regardless of his due care and skill*

But granted that the surgeon did operate against the will of the patient, when the operation was the only chance to save or prolong the patient's life and the operation did not cause the patient's death, it would appear under the law that the surgeon would not be liable, for the reason that society has a higher right to the individual's life than the individual has himself (an individual not having the right to dispose of his own life) Under the facts just stated, if the patient recovers by reason of the operation, clearly he has no action, as what was done by the surgeon was done for the benefit of the person and there is no harm done, and hence no element of damage upon which to base a recovery even though there is a technical trespass If the patient dies, that which was done for him was just as much for his benefit, and his death was not caused by the operation nor was life shortened, and hence there is again no element of damages upon which to base recovery.

Further, under such a set of facts, it would be impossible for the operation to be the proximate cause of death For this reason there could be no recovery in law

"If a physician be guilty of malpractice, but the operation, no matter how gross malpractice, was not the proximate cause of death, there can be no recovery" Braunberger *vs* Cleis, N S 14, 587, American Law Register

If the death of a patient upon whom a surgeon has performed an operation results from disease, and not from the operation, the surgeon is not liable for such death State *vs* Housekeeper, Supra; Wohlert *vs* Seibert, 23 Sup ct (Pa).

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#### AS TO OTHER OPERATIONS DONE OF NECESSITY

*"A class of exceptions as to which there is not much authority, but which certainly exists in every system of law,*



*is that of acts done of necessity to avoid a greater harm, and on that ground justified* Pulling down houses to stop a fire, and casting goods overboard, or otherwise sacrificing property, to save a ship or the lives of those on board, are the regular examples The maritime law of general average assumes, as its very foundation, that the destruction of property under such conditions of danger is justifiable In these cases the apparent wrong 'sounds for the public good' There are also circumstances in which a man's property or person may have to be dealt with promptly for his own obvious good, but his consent, or the consent of any one having lawful authority over him, cannot be obtained in time Here it is evidently justifiable to do, in a proper and reasonable manner, what needs to be done It has never been supposed to be even technically a trespass if I throw water on my neighbor's goods to save them from fire, or, seeing his house on fire, enter on his land to help in putting it out NOR IS IT AN ASSAULT FOR THE FIRST PASSER-BY TO PICK UP A MAN RENDERED INSENSIBLE BY AN ACCIDENT, OR FOR A COMPETENT SURGEON, IF HE PERCEIVES THAT AN OPERATION OUGHT FORTHWITH TO BE PERFORMED TO SAVE THE MAN'S LIFE, TO PERFORM IT WITHOUT WAITING FOR HIM TO RECOVER CONSCIOUSNESS AND GIVE HIS CONSENT These works of charity and necessity must be lawful as well as right" Webb's Pollock on Torts, American Edition, pages 199 and 200

See also, affirming above, Wharton's Criminal Law, Section 146

"Perhaps, too, the various cases which might be supposed of sudden and critical emergency in which the surgeon would be held justified in a major or capital operation without express consent, of the patient might be referred to the principles of implied license" Pratt *vs* Davis, Supra

#### B AS TO THE CONSENT OF A PARENT PREVIOUS TO AN OPERATION UPON MINOR CHILDREN

In any discussion as to the necessity of consent of a parent to surgical operations upon minor children (since no

cases on this subject have ever come up for decision within English jurisprudence), we must look to the basic principles of law governing the matter, for the authority of our statements. Further, the question arises, when does the child arrive at such an age that its discretion is presumptively sufficiently developed that it may have the right to decide as to its need of an operation, without the parent's consent, and against the parent's consent? This would appear to be at fourteen years of age, as will be set forth further on in our opinion.

Under the law in general, when a presumption would arise that the child had or had not arrived at the age of discretion in such matters, that presumption either way would be open to rebuttal on evidence shown, as to the mental capabilities of the child.

Under the Roman Law the father had absolute control of the life of his child. But this was never true under English Law. The duties of the father to the child are those necessary for its maintenance, protection, and education. THE POWERS OF THE FATHER OVER THE CHILD ARE FOR THE PURPOSE ONLY TO ENABLE HIM TO PERFORM HIS DUTIES TOWARDS THAT CHILD AS TO MAINTENANCE, PROTECTION, AND EDUCATION, AND ENABLE HIM TO RECEIVE IN RETURN THE BENEFIT OF THE SOCIETY AND SERVICE OF THAT CHILD. Schouler on Domestic Relations, page 383, 1 Blackstone's Commentaries, page 452, 2 Kent's Commentaries, 203.

Under the Common Law the father had no other powers over the child, except as was necessary to obtain these objects, and no other powers have been conferred on him, except to better enable him to perform his duties, and to entitle him to the full benefits of the society and service of the child.

During the more tender years of an infant's life, a child is not amenable to the laws for its acts, not having sufficient discretion to know right from wrong. According to Blackstone, the age of discretion is twelve years. A child of twelve or fourteen years of age can give a valid consent to marriage. Ward's Estate, 30 Pittsburg L. J., 394. *Beelman vs Roush*, 26 Pa. 509. *State vs Lowell*, 78 Minn. 166.

A father has no right to control the rights of his minor child, who has arrived at the age of discretion, in relation to public worship *Commonwealth vs Sigman*, 2 Clark, 36 *Commonwealth vs Edmunds*, 2 Legal Gazette, 98

A presumption arises at law as to a child's capacity to be guilty of contributory negligence if the child be over fourteen years of age, and hence that they have such discretion as to be sensible of danger *Kehler vs Schwenk*, 144 Pa, 348

In Habeas Corpus proceedings for the custody of children over the age of discretion, the Courts of Pennsylvania take into consideration the wishes of the child *In re Fitzpatrick*, 9 Kulp, 309

In the matter of selection of guardians, Courts of Pennsylvania must consult minors over fourteen years of age

A child of seven years has been held guilty of trespass in this State

"After the age of fourteen, the presumption is that the infant has criminal capacity" *May's Criminal Law*, page 27, and cases thereunder

"On the attainment of fourteen years of age the criminal actions of infants are subject to the same mode of construction as those of the rest of society" *Russell on Crime*, chapter 11 page 7

"Force to the person is rendered lawful by consent in such matters as surgical operations In the case of a person *under the age of discretion*, the consent of that person's parent or guardian is *generally* necessary and sufficient" *Webb's Pollock on Torts*, pages 186 and 187 See also "Law and its Relation to Physicians" *Taylor*, page 315

It will be noted in the above quotation that it does not say, in the case of a minor, or a person under legal age, but expressly states "under the age of discretion"

The age of discretion would be the age at which a child can comprehend the danger of its condition and the danger of an operation when sufficiently informed by a skilled physician or surgeon In other words, when the child is mentally capable to give consent to a surgical operation

Surely no higher degree of mental capabilities would be necessary to raise the presumption of capability to consent to surgical operations than those required to raise the presumption of a child's capacity to be guilty of contributory negligence, or to be held presumptively liable for the most serious crimes

That a child above twelve or fourteen may consummate a valid marriage even against the consent of the parent certainly does support the opinion that a child at the age of fourteen has presumptively the capacity to consent to a surgical operation. Even the crime of rape, recognized as one of the most hideous at Common Law, was never possible if the girl was fourteen and consented to the act. (To make the age of consent otherwise has required the enactment of a statute.)

Hence the age of discretion when presumptively a minor is capable of consenting to a surgical operation without or against the parent's wish would be over fourteen years.

Further, the parent of a child is under duty to see that his offspring does not suffer from the necessities of life, and this includes medical necessities, and conscientious or superstitious opinions of parents that it is wrong to have medical aid is no excuse. See Wharton and Stillé, *Medical Jurisprudence*, third volume of fifth edition, page 441, and cases thereunder mentioned.

SO THAT IT WOULD APPEAR TO BE THE LAW THAT IN THE FIRST CLASS OF CASES OF OPERATIONS, TO WIT, WHERE AN OPERATION IS ADVISABLE, BUT NOT IMPERATIVE TO BE DONE IMMEDIATELY FOR SAVING OR PROLONGING THE LIFE OF THE CHILD, IF THE CHILD IS UNDER THE AGE OF DISCRETION, CONSENT OF THE PARENT IS NECESSARY, the child being incapable to decide as to the skill of an operator, to choose the time of the operation, etc.

But this does not mean that the parent has a right to deny the child the benefit of an operation, when this is clearly and positively the only course of treatment known.

In fact, the father is bound to have the operation performed on the child if the child's condition demands it, as a

matter of medical necessity In other words, it must be clearly held in mind that the father has not the right over the health and life of the child to the child's positive detriment The law will hold him to account if he refuses such benefit

WHERE THE CHILD IS OVER THE AGE OF DISCRETION (while, if possible, it is prudent to have the parent's consent, because no surgeon wishes to be involved in litigation), yet if it is such a clear and positive case that the only course of treatment is that of an operation, it would appear sufficient to have the child's consent to perform the operation, for the reason that the child has a higher right to its own health and life than the father's right over the child's person Further there can be no element of damages where the operation is to the benefit of the child, the benefit conferred being greater than any harm done

Probably, as no decision has been rendered as to the law under these facts, the Court would incline, if the operation be proven of no benefit or that the benefit was not greater than the harm, to allow the parent to recover for the loss of service of the child, even if the child be over the age of discretion However, as the husband's rights to the wife are the society and service of the wife and those of the parent to the child are the same, the identical reasons which the Court has given for ruling that the wife's consent only is necessary, would appear to apply with equal force as to the consent of a child above the age of discretion, being the only consent necessary and the parent's consent unnecessary And as the husband cannot recover under the facts for the wife's services, for the same reasons the parent cannot recover for the services of the child

AS TO THE CONSENT OF THE PARENTS IN AN OPERATION UPON A CHILD WITHIN THE SECOND CLASS OF OPERATIONS, to wit, those where an immediate operation is necessary as the only course of treatment which may save or prolong the child's life (while it would be prudent here, as in all cases to avoid litigation, to have the parent's consent), if the child be of the age of discretion and consents, the consent of the parent does not appear necessary

If the child be of tender years, the surgeon would probably be liable only for any error of judgment, if he operated against the parent's will. The risks of litigation and liability, however, would be almost identical to those referred to in our discussion of operations, in "life and death cases" upon adults against their will.

In serious illness, the father is held by the law under stern duty to provide skilled medical attention whenever possible to do so. It would appear from the very fact that the duty falls upon him to procure a physician, that it is not within the father's judgment to decide what shall be the course of treatment, unless there be a choice known to him, for the very reason that the law demands that he call in a skilled physician in serious illness to give the child the benefit of medical knowledge, of which the father is ignorant.

Where it appears under the evidence that the physician did that which was the only possible thing to be done in order to give the child its chance of life, the very law which requires the father to provide skilled medical attention would require him to allow that this be done. The parent's right to prohibition under such conditions would mean, and mean nothing else, but that the father had a right even to the life of the child, which is an absurd contention in English jurisprudence.

The child has a higher right as to its own life than the father's right as to the person of the child. Society has a still higher right as to the life of an individual member, and hence, where under all the evidence it would appear that the surgeon did, *in a time of life or death, that which was the only course of treatment to be pursued, even if he did it under such circumstances that it was clearly against the wishes of the parent, the surgeon would not appear to be liable*.

The surviving action to parents on the death of a child is for loss of pecuniary services. If the operation does not cause death, no loss of service can be shown as the result of the surgeon's act, and hence the surgeon has no liability. But to protect himself from any error of judgment it would appear the surgeon should have, as a rightful precaution, the

parent's consent, at least where the child is under the age of discretion

The statements made in our discussion as to operations of the second class upon adults and *against their will*, would govern as to operating, in the same class of cases upon minors, over the age of discretion against their will, or upon children, *under* the age of discretion, against the will of the parent

It is as old as the Common Law that if a man be drowning and one goes to his aid, and in saving him, does necessarily and incidentally violence to his person, the one thus aiding is not liable, whether he succeeds in his efforts or not. What he did was for the benefit of the other and for society, and that which the law commends to be done rather than not to be done

AS TO OTHER OPERATIONS DONE OF NECESSITY, such as where a child is found unconscious, and a competent surgeon perceives that an operation ought forthwith to be performed at once, it is lawful for him to do so, the same as in the case of adults previously discussed and for the same reasons

The use of the term "surgeon" herein of course includes only those who are qualified according to law, to hold themselves out as such to the public

Also it is to be understood that the diagnosis, prognosis, and operation have been made with that ordinary due care and skill, taking into consideration the advanced knowledge of the times, which is required of all physicians and surgeons by law

#### SUMMARY

Consent of an *adult patient* in good mental health is sufficient to relieve the surgeon of liability in all classes of cases

*Lunatic Patients*—The surgeon should have the person legally declared a lunatic, if time permits, and have the consent of those legally in charge of the lunatic. If the urgency of the case does not permit such delay, the consent of those directly in control of the lunatic and the "consent" of the lunatic, if possible, should be secured

*In all cases of sudden and critical emergency* the law will imply consent or justify the surgeon's act by implied license This is true as to all individuals, adults or minors

*Minor Children* —Consent of parent and child if possible should be had to protect the surgeon against *litigation* Under the age of fourteen years the parent's consent is especially necessary to protect the surgeon against litigation and error of judgment Over the age of fourteen years the consent of the child, in serious cases, would appear sufficient

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Since writing the above opinion, a case has been handed down by the Supreme Court of Minnesota which the Author considers supports the above opinion The case is *Mohr vs Williams*, 104 N W Reporter, page 12

J F S



# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting, June 5, 1905*

The President, HENRY R WHARTON, M D , in the Chair

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### SILVER PLATE AND SCREW FIXATION IN FRACTURES OF THE TIBIA

DR JOHN H JOPSON showed a boy in whom he had treated a compound fracture of the tibia by primary fixation of the fragments by means of Halsted's silver splint and screws. The wound had healed with the splint *in situ*, and the result was a perfect one as far as the fracture was concerned. There were certain advantages of the splint and screws over silver wire in the primary fixation of recent fractures which Dr Jopson thought were sometimes overlooked. In the present case, operation was demanded in the first place because of the difficulty of reduction of an oblique fracture of the tibia complicated by a small wound. The broken ends had rotated in opposite directions. After incision, reduction was satisfactorily accomplished. To have now drilled and wired the fragments would have required much more manipulation and traumatism than the use of the splint and screws, which were easily applied without disturbing the relations of the bone in the wound, and which held the fragments firmly in apposition. Union took place as rapidly as in a simple fracture. Steel screws were used, as silver ones were not at hand. Nearly three months have elapsed since operation, and, while the wound is still solid, there is a little tenderness and swelling of recent development at the site of the splint, which probably means that it will require removal.

DR JOHN B ROBERTS said that this method had been for years a favorite with Dr L W Steinbach, with whom he was

associated at the Polyclinic Hospital. The expedient was uniformly successful in holding together the fragments, but he thought that lately Dr Steinbach is not so enthusiastic regarding its use. He finds that some of the cases are followed by suppuration, due largely to the necessary laceration of the soft parts in applying the splint. This sequel is more apt to occur in deep fractures than in those of superficial bones such as the tibia, the wounding of muscles and other soft tissues being much more extensive in the former. Notwithstanding, Dr Steinbach secures good results. Dr Roberts has never employed the splint, but once removed one which had been inserted by another surgeon. The fracture originally was a bad one, and suppuration followed. In treating a recent fracture similar to that reported by Dr Jopson, Dr Roberts exposed the fragments and put in two steel staples of his own design, which in some ways are preferable to other devices for holding the fragments in apposition. To insert a wire, the ends of the bone must be freed and drilled, which of necessity cuts and irritates the tissues, in addition, the ends of the bone will wobble when the wires are inserted. Dr Roberts used a staple which possesses two projecting points, which are driven into holes drilled for them in the fragments. This is simpler than inserting screws and gives greater rigidity than is attainable with wire. Dr Roberts has also employed fracture-nails with ends fashioned as drills. These are inserted into the bones and make the apposition of the fragments a rigid connection. They are afterwards pulled out. They possess one advantage in that they may be used in subcutaneous fractures.

DR RICHARD H HARTE said that he had used the Halsted splint a number of times, but does not now employ it so often as formerly. Regarding this appliance, an important point to remember is the necessity of using a long splint. Too many surgeons employ a short splint which furnishes support only at the extreme ends of the fragments. It is best to insert four screws, two in each fragment. If a short splint and two screws only are employed, the support given thereby is very slight, and the method possesses no advantage over wiring. Dr Harte's experience is that removal of the splint is required in essentially every case, removal, however, is a very simple process. As to the use of iron screws by Dr Jopson, he believes such screws are better than the silver ones as ordinarily sold. The latter are imper-

fectly made, the threads being much inferior to those on the iron wood-screws, which he would not hesitate to use in a similar case

DR JORSON, in closing, said the staple described by Dr Roberts appealed to him as being a good appliance, but the Halsted splint has superior advantages. The latter may be cut in desired lengths for any case. In the one reported, the fracture was oblique, and the fragments were held very firmly by two screws above and one below the line of separation. He was quite surprised when the sinus which had formed at the site of a gauze drain underwent spontaneous closure. It will be a simple matter to remove the splint if necessary, and will cause no damage, as the purpose for which the splint was inserted has now been long accomplished.

#### LAMINECTOMY FOR FRACTURE OF VERTEBRA

DR JAMES K. YOUNG presented a woman who fell eight years ago, fracturing the spine in the dorsolumbar region. In the course of her treatment, a laminectomy was performed by Dr Ashhurst at the University Hospital. After three months patient was discharged. She was not able to move below the waist. Sensation was absent.

One year after her fall, she went to the Orthopædic Hospital, where she was under the care of Dr S. Weir Mitchell. She was treated with massage, static electricity, and rest. Improved gradually, until in the course of two months she could walk in a wheeling-crutch. After two months more on crutches she began to walk with a cane.

On October 8, 1904, she came under the observation of Dr Young, who found that she could then walk on a level, but was unable to walk up and down stairs. Was unable to stand alone. Right leg has lack of co-ordination. Massage, electricity, and special movements were directed to be given to encourage co-ordination. The posterior group of muscles in the thigh and calf are the ones most affected. There is some deviation of the spine. Spinal support applied.

June 1, 1905, Dr Young finds that she is able to walk up and down stairs with the use of a cane. Is not able to stand unless she can touch something, must move if she cannot hold to something. Legs are much stronger. The right leg is slightly

numb Ever since the injury, she has had a burning sensation in the right leg in the region of the sciatic nerve This sensation begins in the heel and goes up the back of the leg It is not continuous, but comes and goes She experiences it every day There is pain in the back, in the lumbar region, sometimes severe, and usually accompanied by headache

Recently she has not had as good vision in the left eye as in the right, especially when she is fatigued Tested the vision at thirteen inches, and found the right eye much better than the left She sleeps well, has a good appetite, and the general health is good She jumped several inches from the floor to-day In her own home she frequently walks without support

Dr Young said that his object in presenting this case was to direct attention to the importance of the after-treatment of fractures of the spine, particularly by the use of spinal supports, massage, electricity, and of every known means which will restore function to the muscles He had frequently been asked to examine cases of fracture of the spine, one or two years after a laminectomy, where a marked kyphosis was present and where efficient support had not been used

#### PARALYSIS OF ARM FROM DISLOCATION OF SHOULDER AT BIRTH

DR JAMES K. YOUNG presented an infant, aged nine months, whose left shoulder was dislocated during birth by traction, resulting in paralysis Electrical treatment was given The case had been diagnosed as birth palsy

Examination, March 19, 1904, showed a backward dislocation of the humerus, with limitation of motion, deformity, and pain upon movement The arm was held rigidly at the side in a position of marked pronation Skiagraph showed backward and downward dislocation of the humerus

He reduced the dislocation April 7, 1904, under anæsthesia Two months later there was some limitation at the elbow-joint, and some rotation of the radius This he broke up by forcible manipulation, under anæsthesia Electricity, massage, and exercises were given, which was followed by marked improvement, continuing up to the present time

His object in showing this case was to direct the attention

to the frequency with which dislocation of the shoulder is mistaken for birth palsy. Injury to the brachial plexus may result from injuries during birth, but dislocations of the shoulder, if allowed to continue, will produce pressure palsies resembling birth palsies, as in the case exhibited.

#### SPIRAL FRACTURE OF THE HUMERUS CAUSED BY JIU-JITSU

DR GEORGE MORRIS DORRANCE presented a boy, aged fourteen years, who came under his care at St Agnes's Hospital on March 30, 1905, with the history that while practising jiu-jitsu with a playmate he had fractured his humerus. The hold gotten by his opponent consisted in catching him by the left wrist with the forearm flexed on the arm, and rotating the forearm outward.

When seen by Dr Dorrance the deformity consisted of an outward and upward displacement of the upper end of the lower fragment with one and three-fourths inch shortening, this was overcome by putting the arm on an anterior angular splint with four pounds hanging from arm. At present he has one-half inch of shortening, with full power and use of arm. Massage and passive movements were started on the seventh day, and continued for five weeks.

DR RICHARD H HARTE said the skiagraphs shown by Dr Dorrance illustrated what he had seen in a fracture caused by a similar accident. Two men engaged in a friendly trial of strength attempted to throw each other's arm to the side, and the humerus of one was fractured. Some time afterwards the man died from other causes, and the specimen showed the same kind of fracture as that just reported. The line of separation was spiral in shape, as though the bone had been twisted off.

#### OPERATIONS PERFORMED AT THE GERMAN HOSPITAL

DR JOHN B DEAVER presented a report giving an analysis of the operations performed at the public clinics for students held at the German Hospital during the session of 1904-05.

# TRANSACTIONS

OF THE

## CHICAGO SURGICAL SOCIETY.

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*Stated Meeting, May 1, 1905*

The President, L. L. McARTHUR, M D, in the Chair

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### GENERALIZED SYSTEMIC BLASTOMYCOSIS

DRS. D N EISENDRATH and OLIVER ORMSBY reported the following case

The patient was a Polish laborer, aged thirty-three years, married, and had two healthy children. Had been ill since February, 1904. Was admitted to the Cook County Hospital in February, 1905, and assigned to the service of Dr. Eisendrath.

His present trouble began in February, 1904, the first noticeable departure from his usual good health consisting in a feeling of discomfort, involving the chest on the right side and extending clear through from front to back. This lasted for some time, and, in fact, is still present, being better and worse at intervals. In June, four months later, his first cutaneous lesion appeared. This was located below the left ankle and extended down to the heel, and eventually became a little larger than a dollar. Shortly afterwards the balance of the lesions appeared, but it is impossible to tell their exact mode of development. In addition to this area, the right leg had several large lesions, also the right and left forearm, and the face, chin, and neck, especially on the right side. Most of these lesions were quite superficial, the larger part of each being an ulcer, crust-covered in places, open in others. There was little induration but considerable sanguinopurulent discharge. The edge of the ulcer was slightly elevated and presented a bluish-red halo, in which there were located a few miliary abscesses. In some places of the area a papillomatous condition was present. The lesion on the arm was a subcutaneous nodule,

which later softened and was incised, and from the sinus left after this procedure, and in pus from both the lesions on the legs, the organism of blastomycosis was demonstrated. There was also present a large swelling on the left forearm, which apparently involved the whole circumference. It began about two and one-half inches below the elbow-joint and extended down the forearm about four inches. It involved both sides of the arm, and suggested the possibility of bone involvement. In a skiagraph of this lesion the bone appeared normal. This swelling was later incised and the same characteristic discharge released. There is still (May 1) marked involvement in this area. The lesions on the face protruded more extensively above the level of the skin and were papillomatous, and some were even verrucous. There was much discharge and marked crusting.

About November, 1904, great muscular weakness set in and marked swelling of the feet and ankles occurred. This gradually increased until he was unable to work. On his admission to the hospital, in February, 1905, he presented lesions on all the above-mentioned areas, and was very much emaciated, pale, anæmic, exceedingly weak, and had some elevation of temperature. Marked œdema was present in the ankles, feet, face, and arms. He coughed only occasionally. Although the patient constantly denied having a cough or expectoration of any moment, and although his attendants at the hospital had not noticed these symptoms, on April 26 a large amount of blood-stained mucopurulent sputum was collected, in which the organism was plentifully found. On March 22, pus was removed from a subcutaneous, unruptured abscess situated on the left forearm and inoculated on various media, and later in animals. Pure cultures of blastomycetes grew on all the cultures. On March 28, six days after this inoculation, growth was plainly visible, and after this the cultures grew rapidly. These were pure cultures of blastomycetes. While, as is usual, only spherical and budding forms appeared in the fresh pus, segmented mycelium, with lateral conidia, grew on the media. This pus was stained for tubercle bacilli, with negative results. Blood cultures, thus far, have been negative, as has also examination of the urine relative to blastomycetes. Albumen and casts were present, however, in the urine. On March 23, tuberculin was given with negative results. No tubercle bacilli have as yet been demonstrated in

sections or pus. This examination is far from complete. During his two months' sojourn at the hospital, his temperature has ranged from 98.6° to 102.8° F. The latter half of the time the temperature has been considerably lower. As a rule, there is an exacerbation each evening. Under large doses of potassium iodide internally, with radiotherapy, antiseptic dressings, and surgical interference locally, marked improvement has occurred. The cutaneous lesions have largely healed and the patient has gained in weight, but he still has much infection internally, as evidenced by the numerous organisms demonstrated in the sputum only five days since, and also by other general symptoms.

Animal inoculations are under way, but no report can be made as yet.

DR FRANK HUGH MONTGOMERY called attention to the increasing number of systemic cases of blastomycosis. In addition to the four published cases referred to by Dr Ormsby, the one reported by Curtis, in France, was undoubtedly of the same nature, and the five or six cases reported from California as "Protozoic Disease" or "Coccidoidal Infection" were almost identical with systemic blastomycosis in clinical symptoms, including fatal termination, and in the organisms cultivated. The organisms in the California cases, however, differed from those found in blastomycosis in that in tissue they developed by endogenous spore-formation and never by budding. This distinction called for a separate classification of these cases at present. Though it was known that some varieties of blastomycetes, under certain conditions, might multiply by endogenous spore-formation, in all the cases of blastomycosis so far studied the organisms in the tissue developed by budding. Although frequently in cultures and a few times in tissue the speaker had seen blastomycetes which contained what appeared to be spores, he had never been able to trace the further development of these spores either in tissue or in cultures.

In addition to the reported cases, there were now in the neighborhood of Chicago at least five individuals under observation suffering from a systemic infection with blastomycetes, and several other cases in which systemic infection is probably present. In view of the number of generalized cases now recognized, the subject of blastomycosis was becoming one of general medical and surgical interest, and could no longer be limited to the field of dermatology.



## DIFFUSE MULTIPLE FIBROMA MOLLUSCUM

DR DANIEL N EISENDRATH presented a man, sixty-five years of age, who stated that he noticed the development of these tumors about forty years ago. The chief reason for showing the patient was more as a medical curiosity than from a therapeutic stand-point. The man presented himself at his clinic at the College of Physicians and Surgeons about three weeks ago. Microscopically, these numerous tumors were composed of soft fibromatous tissue. Some of the tumors were considerably larger than others. Those on the breast were quite large. Some of the tumors felt much harder than others, and as though they contained cartilage. He exhibited photographs of a similar case seen at the County Hospital.

Whether this disease had something to do with the nervous system was still an unsolved question. Sometimes the disease was symmetrical, at other time it was not. It appeared in various places on the face in some, while in others there were no tumors on the face. In the present case the man had an unusually large number, chiefly confined to the anterior and posterior surfaces of the trunk.

## SCHEDE'S OPERATION FOR EMPYEMA

DR D A K STEELE showed a young man, German-American, twenty-eight years of age, who was taken sick a year ago last February with pulmonary trouble. He saw him in the latter part of January or the early part of February of this year, about a year after his illness began, and at that time he was suffering from a chronic empyema of the left chest. He had been under the care of a competent physician for a considerable length of time, had been treated by him, and the chest had been aspirated repeatedly. Subsequently a drainage-tube was introduced between the ribs. There was a great deal of emaciation, the patient was cachectic, and drainage at the time he saw the patient was inefficient, the drainage opening being filled up with granulation. Patient went to Wesley Hospital, where a couple of inches of rib were resected, and a double drainage-tube introduced, the cavity flushed, and treated in the ordinary way for a few weeks.

Patient returned home, and the irrigation of the empyema cavity was continued after he returned home. Two or three weeks ago, as the patient was not doing very well, he advised the resection of all the ribs from the second rib down on the left side, a typical Schede operation for the purpose of obliterating the empyema cavity. Patient again entered the hospital on the 30th of March, and was anæsthetized, the first operation having been done under cocaine anæsthesia, the second under general anæsthesia. The ordinary curved incision was made, the incision being made so that he was able to remove all the ribs from the second down along the costal cartilage to the bottom of the pleural cavity and along the tubercle of the ribs posteriorly up to a corresponding height. The incision through the soft parts was made by a single sweep of the knife, the parts dissected, the arm carried over the head, and the soft parts retracted with large hooks, and then with a curved rib-cutter the ribs were divided, the cartilage very readily and the ribs on the posterior side. The whole operation was done as quickly as possible because of the danger of collapse. There was no hæmorrhage requiring a ligature. There was oozing from a few blood-vessels, which were caught with clamp forceps. The soft flap was turned up, which gave a beautiful view of a dextrocardia. Pulsations could be seen because the whole left side of the man's chest was exposed to view. The lung was collapsed and bound down, there was a thick plastic exudate covering the lung and pericardium, and the surface of the chest wall, which was removed by a large spoon curette, scraping away rapidly, and the operation was completed by packing the cavity with strips, four inches wide, of iodoform gauze in layers, brought out at the posterior angle of the wound. The upper portion of the wound was closed with a few interrupted sutures, and nearly all the anterior and lateral portions closed in the same way. The cavity had not yet completely closed. The upper two-thirds of it was closed, but there was still a small cavity below where he did not remove the ribs quite far down. There was one point of infection over the costal cartilage (about the sixth or seventh costal cartilage) where there was a spicule of bone, where he did not trim the edge as closely as possible.

The cause of the empyema was a tubercular pleurisy primarily, a mixed infection, with the ordinary after-history

Dr Steele said the Schede operation was reserved for only a limited number of cases. In young people the majority of the cases of empyema got well, perhaps, with multiple aspirations, another large number of cases were cured by a less radical operation than this, known as the Estlander operation, by which a portion of the ribs only, usually upon the anterior part of the chest, was removed. But there were a certain number of cases, however, in which the chest wall would not collapse, and in which it was impossible to obliterate the empyema cavity unless one removed the ribs and soft parts and curetted, freshening the parts, so that the opposing pleural surfaces might be covered with a fresh integumentary and muscular flap after the removal of the ribs. This would enable the obliteration of the cavity except on the left side, where there remained the condition now observed.

He saw a case six years ago that was operated by Dr Roswell Park, of Buffalo, which presented very much the same appearance as this man's case presented several years after operation, in which the empyema cavity had become completely obliterated, but there was a window-like appearance of the chest, the serous surface having assumed a parchment-like, dry appearance, and the man carrying one-quarter pound of cotton batting to protect the pericardium from external injury. He thought the same thing would occur in this case, although he hoped the cavity would become obliterated. It did not appear now, however, as though it would be. He hoped the concave or cup-shaped cavity would stop secreting after awhile. It might remain permanently open, but without discharging, provided the man lived long enough. In the upper portion of the right lung there were already new foci of tubercular infection, patient's sputum contained a large number of tubercle bacilli.

He exhibited the ribs that were resected from the left side.

DR ARTHUR DEAN BEVAN confirmed what Dr Steele had said with regard to the difficulty of obliterating the cavity at the upper portion of the pleural space. In text-books, and in many descriptions, the cavity is described as being one with the largest portion below. As a matter of fact, in almost all empyemas the large cavity is above, opposite the second, third, and fourth ribs,

sometimes as low as the fifth. The lower part of the space, as a rule, was obliterated by the gradual encroachment of the diaphragm upon the lower part of the pleural space, the crowding up being produced by intra-abdominal pressure, and a lack of similar opposing pressure, or the normal pressure one would expect from the lung. He had found in his cases both by filling the cavity with iodoform emulsion and taking an X-ray view, and at the time of exposure the large part of the cavity was at the upper angle. He thought that it was a simple matter to obliterate in an empyema case the lower part of the space. The great problem, however, was to obliterate the upper portion.

In the last three cases operated on by the Schede method, he had adopted a scheme which had been of a great deal of value, namely, after making a Schede operation, early encouraging the patient to develop the lung on the opposite side, or the remnant of the lung on the affected side, by persistent efforts at respiration, either with a water-bottle or with a rubber bag, and in two cases the results had been admirable. In the case of a boy, six years of age, in whom there was quite a considerable cavity at the upper angle, he started him shortly after the Schede operation at blowing up a rubber bag every day, even before there was any effort at much repair, and there was developed opposite the second and first ribs enough lung tissue to obliterate entirely the cavity. And he wanted to make that special point, although he had called attention to it before. But he thought it was really worth while to emphasize the point in empyema, that the difficult portion of the cavity to obliterate was the upper part, and that very early, if one did a Schede operation before wound repair was at all complete, effort should be made to expand the upper portion of the lung or to fill in that portion by an expansion of the lung of the opposite side.

#### LEFT INGUINAL CONGENITAL HERNIA, WITH TWO TESTES ON THE LEFT SIDE

DR A E HALSTEAD presented a man, thirty years of age, who was operated upon at the Cook County Hospital on the 11th of April, this year, for a left congenital inguinal irreducible hernia, which contained omentum at the time of the operation.

He showed him because the patient presented an interesting anomaly in the development of the testicle. After opening a

very large sac and ligating off a portion of the omentum, he pulled up the cord, which seemed to be rather thick, and in doing so dislocated from the left side of the scrotum a pair of testicles. The epididymis was very large and fused, showing the two organs that had originally existed. The cord contained two vasa deferentia, two spermatic arteries, two sets of veins, inclosed in one vaginal process. This double cord passed through the left inguinal canal. The right side of the scrotum and the right inguinal ring were empty.

He did not have an opportunity to photograph the specimen at the time, but he thought the members by examination could determine that there was no right spermatic cord, and that the left side of the scrotum contained two testicles.

The hernia presented nothing unusual, excepting that it was somewhat larger than is ordinarily seen. A rectal operation was performed on the man afterwards, and he learned that the prostate was symmetrical. There appeared to be but one large seminal vesicle.

#### ADVANCED HODGKIN'S DISEASE

DR DANIEL N EISENDRATH presented a patient who had been under X-ray treatment by Dr J F Smith, during which time he had shown remarkable improvement. He said it was a case of very advanced Hodgkin's disease, in which internal treatment had been tried for a number of years without much benefit.

DR JOSEPH F SMITH said the man was twenty years of age, and about five years ago first noticed the appearance of these swellings in the neck and axilla. About six weeks ago patient was sent to him by Dr Eisenrath, with the request that he be treated with the X-ray. The patient was under X-ray treatment three or four times a week, and since that time he had improved very materially. At the time treatment was commenced his neck was eighteen and a quarter inches in circumference, and in making a measurement a short time ago he found there had been a diminution of about one inch and a quarter in circumference. The patient had had a marked reaction from the use of the X-ray two or three times, so that treatment had to be discontinued on that account. The glands in the axilla had responded much more rapidly to the influence of the X-ray than

had those in the neck, although at the time treatment was commenced he had an enormous mass of glands on the left and right sides of the neck. The mass of glands in the axillary space had nearly disappeared.

Patient was operated upon two years ago by Dr Halstead, who removed at that time a mass of glands from the left side of the neck, but there was a recurrence in a short time. The interesting features in the case were the number of enlarged glands and the degree with which they had responded in six weeks to X-ray exposures. There were still a great many enlarged glands present, but the neck had diminished very materially in size.

DR EISENDRATH said that Dr Halstead mentioned the fact to him that he had operated upon the patient two years ago for tubercular glands of the neck. He (Eisendrath) had under observation at the present time an atypical case of Hodgkin's disease. There were twenty or twenty-five glands on both sides of the neck enlarged, also a number in both axillæ and both groins. Dr Burroughs, who is associated with him in the clinic, told him that he had operated on the man himself a year ago and removed caseous tubercular glands. This case brought up the point as to whether there was a certain relation between pseudolymphatic glands and tuberculosis. His attention was called to this in Vienna in 1892, during which time he saw a number of cases of Hodgkin's disease in which there were tubercular lesions shown in various parts, as tuberculosis of the spleen, liver, and so on.

DR HALSTEAD stated that he had operated on this patient two years ago, at which time he removed several enlarged cervical and axillary glands on the left side, sections of which were made for microscopical examination, and which were shown to be typical tubercular glands. A large number of tubercle bacilli were found. There was nothing at that time to indicate that the man had Hodgkin's disease, and personally he did not believe that he had such a disease now. The man did not look like a patient who had Hodgkin's disease. His great muscular development, lack of anæmia, and his general good physical condition spoke against such a diagnosis. The fact that the man had two years ago nothing but tuberculosis led him to believe that the case was one of the type of pseudoleukæmic glandular tuberculosis, and not Hodgkin's disease.

DR EISENDRATH replied that the diagnosis of Hodgkin's disease was made on account of the blood findings being negative. If he remembered rightly, there were 10,000 leucocytes, with none of the other characteristics. The number of red corpuscles was normal. Then, too, he considered the large number of enlarged glands, and their universal distribution over the different glandular regions. He did not know that the patient was coming to the Society this evening, as, if he did, he would have given the case and its history more careful consideration. At a glance, however, one would scarcely think it was anything else except the typical picture one was accustomed to see of Hodgkin's disease. On account of the great improvement under X-ray treatment, he requested the privilege of showing the patient.

In going over the differential diagnosis of this case as to whether it was Hodgkin's disease or not, he could not see what else it could have been, except it be one of those cases of atypical Hodgkin's disease which he had at the present time, and was on the border-line between Hodgkin's disease and tubercular glands of the neck, which border-line he did not think was sharply set. There were cases, like the one he had under observation at the present time, in which the number of enlarged glands did not show any tendency to caseation. Furthermore, there were so many enlarged glands scattered in different parts of the body that he hardly knew what to call the case except an instance of Hodgkin's disease.

DR L. L. McARTHUR called attention to a fact brought out by Dr. Reed, of Johns Hopkins, that fully 50 per cent of these cases in which the glands were examined microscopically, with the clinical diagnosis and ear-marks of Hodgkin's disease, were proven to be both histologically and microscopically hypertrophic glandular tuberculosis.

DR HALSTEAD called attention to the work of Fisher on diseases of the lymphatics in which he (Fisher) describes a type of tubercular lymphatic disease, or the pseudoleukæmic form of lymphatic tuberculosis, in which there was but slight tendency to caseation. The disease progressed usually to a fatal termination. He had seen such a case at the Cook County Hospital, where the post-mortem examination, made by Dr. Hektoen, where the bronchial glands resembled a bunch of bananas. The glands were

very large, and many of them were examined, but none showed any signs of softening or of breaking down. In all tubercle bacilli were found in great numbers.

## DISTENDED GALL-BLADDER

DR WILLIAM M HARSHA reported the case of a woman, aged fifty-three years, who was first seen with Dr R E Brown, July 10, 1904. History then obtained was that patient was seized with general abdominal pain July 5. Distention of the abdomen increased gradually without temperature, there was no bowel movement since attack, vomiting more or less every day, assuming intestinal character the last two days. July 10, temperature, 100° F, great abdominal distention, intestinal regurgitant vomiting, anxious expression, small pulse, 100.

A median incision was made below the umbilicus. Exploration of the abdomen discovered an enormously distended gall-bladder, reaching below the level of the umbilicus, intestines distended, with no other cause apparent. Median incision was temporarily closed by gauze sponges. Incision was made over the site of the gall-bladder, and the gall-bladder emptied of a pint or more of mucus and bile, including forty or fifty gall-stones, some of which occluded the cystic duct. After draining the gall-bladder in the usual way, a ventrofixation of the uterus was done, and a median incision closed. There had been for some years complete prolapse of the uterus. The patient made a prompt recovery. Bowel movements occurred within a few hours after the operation. He had been able to find no such case recorded in the last five years. But the late Professor Fenger reported a case of this kind in the *Chicago Medical Recorder*, 1898, page 310, as follows: "Symptoms of acute intestinal obstruction, seemingly with peritonitis, and nothing to point to the biliary tract. Median incision. Peritoneum normal throughout. Intestines uniformly distended and nowhere obstructed. A distended gall-bladder was the only abnormality found. The median incision closed and lateral one made over the gall-bladder. Gall-bladder considerably enlarged, tense, free from adhesions, and somewhat congested. Thinking the condition of the gall-bladder might not be the cause of the obstruction, but that the latter might be dynamic and of unknown cause, I resolved upon cholecystostomy in two stages. The symptoms of absolute obstruction continued

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unabated After thirty-six hours the gall-bladder was opened, pus and stones evacuated, and symptoms of intestinal obstruction ceased immediately

### OVARIAN CYST WITH TWISTED PEDICLE

DR HARSHA narrated the history of a woman, thirty-three years of age, who for several years had had attacks of obstruction of the bowels lasting three or four days, during which time she was confined to bed with pain and vomiting November 27, 1904, she was first seen by Dr Harsha when she was just recovering from the most severe attack of this kind which she had ever experienced Her physician, Dr Hilton, gave the following account of the attack November 23, patient was suffering from profound shock, cold surface, irregular pulse, vomiting of intestinal contents, and constant desire to empty the bowels The exhaustion amounted to collapse There was no bowel movement for four days Examination on November 27, 1904, discovered a small ovarian cyst on the right side Operation, December 1 Cyst found the size of a small orange, with twisted pedicle, which was removed, patient recovering promptly, and having no symptoms of intestinal obstruction since No peritonitis apparent, no gangrene of cyst, twisting not sufficient to shut off blood supply There were slight adhesions at the outer side of the cæcum, at the end of the appendix, evidently of long-standing, and apparently not capable of causing any symptoms of obstruction

To this case he added an account of a second case in the person of a woman thirty-five years of age, who was first seen with Dr Z H Going, April 24, 1905 He gave the following history April 21, patient had pain in the right lower abdomen Two weeks before she had similar pain, which ceased in two days The patient was in bed, with the right thigh flexed, great tenderness over the right lower abdomen, vomiting, no temperature, pulse, 78 April 22, less pain, due probably to anodyne Examination showed a fluctuating tumor in the right side of the pelvis, great abdominal tenderness April 24, pain severe, patient restless, with anxious facial expression, pulse, 105, temperature, 101.5° F April 25, operation performed An ovarian cyst the size of a foetal head, with twisted pedicle, was found and removed The cyst and pedicle were black to within an inch of

the uterus Prompt recovery followed the removal of the cyst In this case there was obstruction of the bowels since the date of the attack, April 21 But the symptoms were not so urgent as in the former two cases There was no intestinal vomiting It was not uncommon for two or three days to elapse without bowel movement Operation was not done for the relief of obstruction of intestines only, but on account of the tumor, with increasing signs of infection Vaginal section was first made, and tumor palpated It readily passed up from the pelvis to the abdomen, presenting a central fluctuating tumor A median abdominal incision was then made In the first case of distended gall-bladder, it might be that the pressure on the colon was sufficient to cause obstruction There was no peritonitis, and no pus in the gall-bladder

In the other two there was no involvement of the intestines in any mechanical way that would account for the obstruction, and it seemed probable the obstruction was reflex In none of these cases was there any evidence of local peritonitis to which the obstruction might be ascribed

DR A J OCHSNER said he had seen a duplicate several times of the first case reported by Dr Harsha He had seen several cases of intestinal obstruction similar to this case and from the same cause, and in each instance the obstruction was supposed to be mechanical He had opened the abdomen a number of times in cases in which there was obstruction opposite the entrance of the common duct, in which there was a distended stomach and distended duodenum, and upon lifting the transverse colon the jejunum was found in the same condition which one sometimes finds other portions of the small intestine, simply assuming the form of a string, and in these cases the patients vomited bile precisely as they did in case of mechanical obstruction The obstruction was in the cystic duct, or, as in one case he saw, it was in the lower end of the gall-bladder, due to a wedged-shaped stone which had lodged in this position

Symptoms of obstruction in connection with ovarian cysts, with twisted pedicles, were not so very uncommon He had seen such cases, and in one the patient's abdomen was opened by a country physician for the relief of the obstruction, and finding a black mass, the patient was transported to the Augustana Hos-

pital in this city, and the speaker found the condition which Dr Harsha described in his second and third cases. He recalled several such cases among his cases of twisted pedicle, one an early one, in which he and a number of others made a diagnosis of mechanical obstruction, volvulus, but the operation showed the presence of an ovarian cyst with twisted pedicle. It is easy to make a wrong diagnosis in these cases because the history corresponds to that of a volvulus.

#### BROWN ATROPHY OF THE HEART AS A RESULT OF CHOLECYSTITIS AND A COMPLICATION OF CHOLECYSTECTOMY

DR BAYARD HOLMES read a paper with the above title, for which see ANNALS OF SURGERY FOR DECEMBER.

DR DANIEL N EISENDRATH asked how the post-mortem findings could be reconciled with the clinical symptoms of sudden dyspnoea, cyanosis, and death?

He asked whether a search was made of all branches for embolism of the pulmonary artery or a blood-clot lodged in one of the branches of the pulmonary artery, because those dangers were comparatively frequent after all abdominal operations. A number of such cases had been recently reported in Brun's "Beitrag" and in Heidendoerfer's clinic. He thought it was impossible to avoid these complications.

Carelessness was shown in the examination of the urine, as it was done in ordinary hospital routine work, and one was apt to examine simply a single specimen before operation and be satisfied with it. He thought a rule ought to be made, before opening the abdomen in any case, to have a twenty-four-hour specimen examined, and an examination very carefully made for evidences of nephritis. He had had one experience which taught him a lesson, and that was in a patient older than the one operated upon by Dr Holmes, in whom there was a latent nephritis. The urine was examined a number of times by her physician, yet after the anæsthetic was given nephritis developed, that threatened her life for at least twenty-four hours, the case terminating in a fatal uræmia.

DR ARTHUR DEAN BEVAN asked Dr Holmes if death in his case could not have been ascribed to an atheromatous condi-

tion of the coronary arteries? He had seen cases of death from anæsthesia, posted by competent hands, and yet nothing else was found at the post-mortem examination to explain the death except a general atheromatous condition, and especially atheroma of the coronary arteries. It was a well-recognized fact that, even without an anæsthetic, a condition of atheroma of the coronary arteries was capable of producing sudden death, being preceded by cyanosis and dyspnœa. He remembered distinctly a case occurring in the pathological institute in Leipsic, in which death occurred shortly after the administration of the anæsthetic, within an hour or two, in which the same picture was found, and Birch-Hirschfeld ascribed death to atheroma of the coronary arteries, or to an atheromatous condition rather than to any other fact.

He thought it was too early to place the sudden death in Dr Holmes's case in the category of cases which were now being very carefully studied of the late poisonous effects of anæsthetics, accompanied with acid intoxication. These usually appeared later, seldom inside of thirty-six hours, and from that time on, and would be accompanied with fatty changes in the liver and kidneys, possibly with the changes which Dr Holmes had described also in the heart, although Dr Bevan imagined they were chronic in character.

DR HOLMES, in closing the discussion, said the autopsy was made with the utmost care and deliberation, and the blood-vessels of the lungs were examined for thrombi as well as the blood-vessels of the liver and those in the neighborhood of the operation. He had neglected to say, however, that the cœliac axis was very extensively atheromatous, while there were only a few patches of atheroma in the hepatic, gastric, and splenic arteries.

Examination of the urine was conducted in this way. A single specimen was passed and examined in the office when he first saw the patient, and before he had any assurance the case would come for operation. Some weeks afterwards the patient appeared for surgical treatment, and at that time a twenty-four-hour specimen was examined, a second specimen was also examined, but it was not a twenty-four-hour specimen. After the operation, six ounces of urine were passed and examined, after death the bladder was catheterized, the urine examined, but in

none of these examinations were any casts discovered or any albumen found. How this could have been the case, he did not know, because he thought the woman ought to have had casts in her urine, and that these should have been discovered, and if they had been discovered, it would have put him on his guard.

It was an oversight not to have had an expert to examine her heart. His own opinion was that the woman died from disease of the coronary arteries, just as an old man of seventy might die after an anæsthetic. It seemed rather remarkable to him that this woman had died under the circumstances, as the operation was extremely short, occupying only thirty-eight minutes, which included scrubbing of the abdomen before the operation, and the application of the dressing. Gas and ether were the anæsthetics used. There was one thing radically wrong. The woman was allowed to go out, she had two or three dinners in the week before operation, and at these dinners she had something to drink as well as something to eat. She had a good time. He thought this was absolutely wrong under the circumstances and the condition she was in.

The temperature was subnormal after the operation, it was never normal, and it was  $97.5^{\circ}$  F at the lowest. Immediately before death the pulse rose to 120, and during the last twenty minutes of life the pulse went down to 80 and 50, according to the count of the interne. The changes were so rapid that, although he started for the hospital as soon as he heard things were going wrong, the patient was dead before he reached the hospital.

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*Stated Meeting, June 7, 1905*

The President, L. L. McARTHUR, M.D., in the Chair

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#### BIOLOGICAL ASPECT OF CARCINOMA

DR. G. N. CALKINS, of Buffalo, N. Y., after discussing at length the reasons why the differentiated epithelial cell began the process of abnormal division, resulting in the development of

carcinoma, mentioned the studies that had been undertaken relative to the nature of division energy of the cell, to find out what it was that would control it, what would increase its activity, what would decrease its activity, what stimuli were necessary, what conditions of metabolism and morbidity had their effects upon the division energy of the cell, etc

He mentioned the theories in vogue which had to do with the explanation of the stimulus of division energy of the cell. Of the various theories advanced, he considered only two. The first, Marchand's, which was analogous to the stimulus of the insect poison on plant cells, and, second, the parasitic hypothesis.

He made a brief statement of the work on mice which they were doing in the study of cancer at the State Cancer Laboratory in Buffalo. They had in Buffalo some 200 mice with carcinoma. The original tumor came from a mouse which Dr Gaylord brought with him from Professor Jensen's laboratory in Copenhagen in February, 1904. The mice Dr Gaylord brought with him, when they arrived in Buffalo were dead. They died on the way from New York to Buffalo. The tumors were removed and put on ice. In three days, when mice had been obtained, the tumors were transplanted into normal mice. Fifty per cent practically of the transplantations took, and a large number of mice developed carcinoma. In transplanting, a bit of the tumor is ground up with salt solution, the fibrous material is removed, and this cancer mush, as they call it, is either injected or inoculated under the skin in the cervical region, about one-tenth of a cubic centimetre being put into each mouse. In from ten days to two weeks a tumor made its appearance, showing that the inoculation was successful. In three, five, or six weeks the mouse developed symptoms of cachexia and ultimately died. The tumors that developed varied in size from one-third the weight of the mouse plus the tumor to one-fifth. These tumors were transplanted from mouse to mouse as they died, nine times in their series. Professor Jensen had transplanted the tumors from mouse to mouse for a period of two and a half years before Dr Gaylord brought mice from his laboratory to Buffalo, so that altogether there had been, in all probability, about thirty to thirty-five generations or transplantations of this tumor. These tumors were nothing whatsoever but metastases from the original growth. The cells of the old tumor in the new

environment were stimulated to grow and develop into a new tumor. According to the Marchand hypothesis, the primary stimulus which the first mouse received was a poison which originated from a deranged metabolism, from malnutrition, or from some other product of morbidity in the organization of the mouse.

Were we to assume that there was formed in every mouse morbid products which carried the stimulus forward? In other words, can the organism produce a stimulus which carries on its own degenerative disease factors?

On the other hand, according to the parasitic hypothesis, we might assume that the original mouse which developed the primary tumor had a parasite, that this parasite developed a poison. When it came to stimulation and to division energy, there seemed to be some poison of one origin or another. With the parasitic hypothesis, it was a parasite that produced the poison. Should we say that it was a single parasite or a group of parasites which produced the primary stimulus, which carried the division energy through generations of tumors, a large mass of cells which represented ten or twenty times the actual weight or size of the mouse, or should we say that every epithelial cell had within itself parasites which kept on producing a stimulus that kept up the division energy? There was absolutely no morphological evidence in cancer cells upon which to base such a fact.

The advocates of the parasitic hypothesis were forced to the conclusion that the parasite at present must be ultramicroscopic. The speaker, however, did not wish to advocate that view. He said, however, it was gaining ground throughout the scientific world. Scharbin, the most eminent parasitologist, believes in the ultramicroscopic organism. The Pasteur Institute had practically accepted this explanation of many diseases. There were pathologists here and there who were loath to believe in an ultramicroscopic parasite. There was one point which would seem to support either hypothesis, according to the results they had obtained with tumors and mice.

In November of last year a tumor began to deteriorate, the mouse showed signs of natural immunity and ability to throw off the disease that it had taken. A great many mice spontaneously recovered. They had had altogether over 150 cases of spontaneous recovery from true carcinoma in mice. They thought the tumor material was growing physiologically old, and

that it would die out and their means of experimentation would be lost. A tumor, however, was transplanted to a new strain of mice, and the virulence of the cells was restored, so that the mice died in from three to five weeks after inoculation.

Dr Clews, chemist of the laboratory, conceived the idea that the blood from such a spontaneously cured mouse might have the possibility of immunity. He inoculated some mice who had tumors about the size of a hazel-nut with the immune blood from one mouse that had spontaneously recovered. This was done in a number of cases, and six tumors disappeared by this immune serum. Experiments showed that immunity was successful up to the present time, and carried with it protection to the mice against reinfection.

The experiment was tried again in a slightly different form. Forty-four mice from the same source were taken, twenty-two of them were treated with cancer mush plus the immune serum from the mice which had spontaneously recovered, and twenty-two of them were treated with cancer mush plus the normal blood of normal mice. The only difference between them apparently was the immune factor in those cases in which the mice had spontaneously recovered. In the twenty-two mice treated with this immune serum, three developed tumors. In the twenty-two mice that were treated with normal blood plus the serum, ten tumors developed, just about the proportion of tumors successfully produced by their inoculation method.

This, in brief, was the position, from a biological point of view, of the cancer problem to-day. It was not known what caused the stimulus. It was not definitely known that there was a parasite in cancer. It was not known that the specific poison produced in any way was the cause of carcinoma. Progress was being made. The work being done at the cancer laboratory was of that earnest type which inspired confidence in its results, and it was hoped would ultimately produce good effects.

#### LAW OF ACCELERATING RISK IN CANCER

Dr E. WYLLYS ANDREWS read a paper with the above title for which see ANNALS OF SURGERY FOR DECEMBER

#### THE X-RAY IN THE TREATMENT OF CARCINOMA

Dr WILLIAM ALLEN PUSEY read a paper with the above title, for which see ANNALS OF SURGERY FOR DECEMBER



DR ARTHUR DEAN BEVAN said the first thing that impressed him in the clinical study of carcinoma was that it was primarily a local disease. There certainly was a time in the history of every carcinoma when it was local, limited to one point, sometimes to a few points—concentric foci. One saw clinically occasionally epithelioma, for instance, which, when examined carefully, showed three or four points of invasion very close together. Clinically we saw carcinoma involving occasionally both breasts. These exceptions did not, however, disprove the statement that carcinoma was primarily a local disease.

A second point that impressed him clinically was, that whether carcinoma was a parasitic disease or not, its history was that of a parasitic disease. Whether the researches of the future showed that it was a peculiar clinical stimulus that acted upon the cells and produced these changes, or whether it was a parasite, whether it was purely chemical and independent of any low form of life, or the result of some low form of life, made no difference, the clinical history of carcinoma would remain that of a parasitic disease.

In regard to the present results of surgical treatment of carcinoma, these varied in different regions of the body, and the reports from different clinics varied widely. For instance, some surgeons, who had made several hundred operations for epithelioma of the cervix, state that possibly less than 5 per cent of these cases were permanently cured. Some men even have gone so far as to state that less than 1 per cent of such cases are permanently cured by surgery. On the other hand, cancer of the body of the uterus furnished a far greater proportion of permanent cures. Carcinoma of the larynx furnished a comparatively large proportion of permanent cures, while carcinoma of the breast occupied a rather mid-position between extremely fatal carcinoma of the cervix and more favorable carcinoma of the larynx. An analysis of the different statistics of carcinoma of the breast would seem to show that surgical treatment furnished somewhere between 20 and possibly 30 per cent of permanent cures. In this connection, he said that in the last few years there had been a great effort made to improve the statistics, so far as permanent cure was concerned, from surgical operations in treating carcinoma, and in doing this there had been a certain amount of juggling. In one well-known surgical clinic reports of the

surgical removal of carcinoma of the breast had been extremely favorable. An analysis of the facts, however, revealed this explanation, which in part at least accounted for their very favorable results, *ie*, they had there divided their cases of carcinoma of the breast into two groups, and at the time of operation, or rather after the operation was completed, if in the judgment of the surgeon the case was one which gave good prospects of a permanent cure, it was reported. If the case did not, in the opinion of the surgeon, give a good prospect of permanent cure, it was pigeon-holed in a second group which was not considered in the final statistics. In other words, only those cases which were, in the opinion of the surgeon, favorable to permanent cure after the operation was completed were reported.

Statistics which were based upon the total number of cases operated upon would seem to give, in cases of carcinoma of the breast, the possibility of permanent cure in from 20 to 30 per cent.

There was one other point that had impressed him very much, and that was the three-year limit in connection with carcinoma. It had been taught at one time that, if a patient lived beyond three years without recurrence, there was little danger of such recurrence. A careful analysis of statistics would show that this was not so. Cases of carcinoma recurred three and a half, four, six, and even ten years after operation. There could be no doubt as to this. There was, however, a gradual diminution in the percentage of recurrences as the time period increased from the date of the operation.

He agreed pretty generally with the statements made by Dr Pusey as to the value of the X-ray in epithelioma. He thought, however, it should not be used in cases of thick epithelioma, whether the lymphatics were involved or not. Superficial epithelioma was the form in which the X-ray was particularly of value. He would agree with Dr Pusey, without any hesitation, that in superficial epithelioma the X-ray was the treatment of choice. On the other hand, in thick epitheliomas, say of the thickness of the thumb or the lower lip, it should not be employed. He had used it again and again, and while he had noticed a diminution in size in these cases of thick epitheliomas of the lower lip, yet as weeks went on there was the occurrence of lumps under the jaw, showing general regional invasion. He believed that the

X-ray should be used as an insurance against recurrence after breast amputation for carcinoma, and after operations for carcinoma in locations where we might expect that it would accomplish results. He believed, too, it should be used in the inoperable cases as a justifiable piece of experimental work from which we had reason to hope that we might obtain beneficial results. He felt, however, that the X-ray had been and was being employed, in a manner which required a word of caution from the profession, by men who were using it, and who did not hesitate to call out very loudly the value of their wares simply to make money out of it. There was no doubt but what the X-ray was a valuable agent. It was, however, doing a good deal of harm in the hands of such men, but not, of course, in the hands of scientific men like the essayist.

There were two great dangers from the use of the X-ray. One was that it would produce serious burns in the hands of men who were not experienced in its use, the other was that it would do positive damage when it was used in a case where a surgical operation, if employed sufficiently early, would hold out a good hope of permanent cure, but where delay produced by the use of the X-ray wasted valuable opportunity and lessened the chances of permanent cure.

## CORRESPONDENCE.

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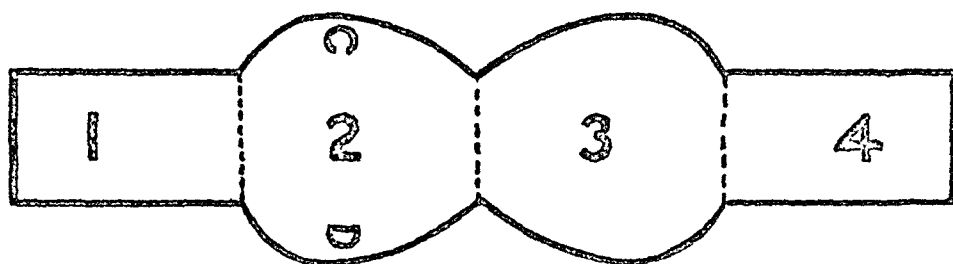
### VAN ARSDALE'S TRIANGULAR SPLINT IN THE TREATMENT OF FRACTURES OF THE FEMUR IN INFANCY AND CHILDHOOD

EDITOR ANNALS OF SURGERY

WHEN discussing the use of the Van Arsdale splint, Dr Ware (ANNALS OF SURGERY, August, 1905) in his reference to my report of cases in the service of the late Professor Van Arsdale, has omitted several important details, to which I beg to call attention, viz .

1 *Measurements*—The length of the splint equals four times the length of the child's thigh from the groin to the patella

2 *Shape*—The shape resembles two "cards of spades"



Segments 1, 2, 3, 4, each cut the length of child's thigh from groin to patella, and flanges C to D the same width. The width of sections 1 and 4 equal thickness of the middle of the thigh. Fold on dotted lines overlapping 1 and 4

joined at their apices (see Figure), the length of each segment being equal to that of the child's thigh. When segments 1 and 4 are overlapped, an acute (not right-angled) triangle is formed which fits nicely in the angle of the flexed leg. In order that the child may be able to sit on a chair or the floor, the ends of sections 1 and 4 may be cut off an inch or two, rendering the angle more acute.

3 *Adjustment*—The flanges should be moistened and bent to adjust them to the surface of the thigh and abdomen, thus giving greater security and immobility. When adjusted, the leg should lie in the long axis of the body, not with the thigh abducted.

4 *Effects*—The extreme flexed position of the thigh relaxes all the muscles and neutralizes any tendency to displacement, the child can sit on the floor or chair and creep about, and the genital and anal regions are well away from the dressings

It is well to take several reverse turns around the knee and over the angle of the splint to give firmness and maintain a certain degree of longitudinal traction on the thigh

Plaster of Paris we have never found necessary, nor has the splint been allowed to remain on the limb longer than three weeks. These details, I believe, will be found of use to any surgeon who may desire to make use of this most useful splint

A ERNEST GALLANT, M D

NEW YORK, October, 1905

### LIGATURE OF THE INNOMINATE

EDITOR ANNALS OF SURGERY

I FIND that in my report of cases of ligature of the innominate in the July number of the ANNALS, I unfortunately omitted one very interesting case, to which Mr B G A Moynihan, of Leeds, has very kindly called my attention. Will you permit me, for the sake of completeness, to send a short abstract of the case now?

H S, male, aged thirty-one years, admitted to Leeds General Infirmary, October 6, 1897, under Mr Moynihan. Tumor in neck of thirteen months' duration. Gradual increase in size, treated with potassium iodide and low diet without much benefit. Syphilis when seventeen. Tumor on right side of neck with ordinary signs of subclavian aneurism. Potassium iodide with rest and light diet for two months, no improvement.

First operation, December 8, 1897. Curved incision, with its convexity downward and attached base upward, made over clavicle and subclavian triangle. Clavicle divided at its inner and outer ends and drawn downward, aneurism exposed, cleared, and excised. Cut ends of vessel ligatured with four strands of 00 catgut. Subsequent to operation, erysipelas and secondary wound infection. Wound healed, and patient gained flesh and strength until February 6, the fifty-ninth day after operation, when "something burst" in the neck, the incision reopened, and repeated hæmorrhages took place.

Second operation, February 8, 1898. Flap reopened. On clearing away clot, "terrific hæmorrhage" stopped by putting finger into opening in subclavian artery. Innominate exposed by a curved incision with its convexity downward and to the left, flap turned upward and to the right, centre of flap lay over right sternoclavicular joint. Inner end of

clavicle and adjacent portion of sternum divided and turned upward with attached sternomastoid Common carotid and innominate ligatured with fine silk Patient very collapsed, and died one hour later

*Necropsy*—Place of original ligature of subclavian soundly healed Hæmorrhage due to the rupture of a second aneurism of the subclavian proximal to the first Extensive degeneration of the walls of the aorta and other vessels (ANNALS OF SURGERY, July, 1898)

The addition of this case makes the number of cases of ligature of the innominate thirty-seven, with eight recoveries

WILLIAM SHEEN, M D

CARDIFF, ENGLAND



"The following plates are to illustrate Dr Alexis V Moschocowitz's article on 'Dry Iodine Catgut,' pages 321 to 351 inclusive, in the September number, and are to replace the illustrations opposite pages 326, 327, and 334



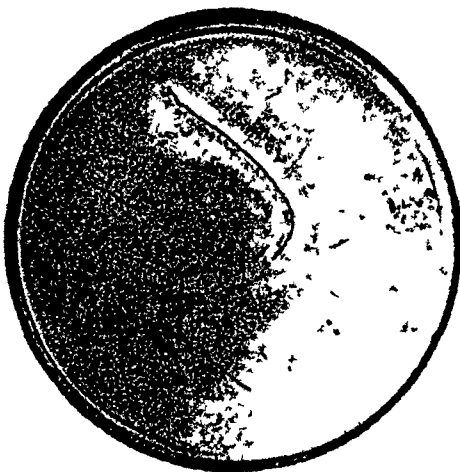
No 52 Agar infected with *Bacillus coli*, with iodine gut on top



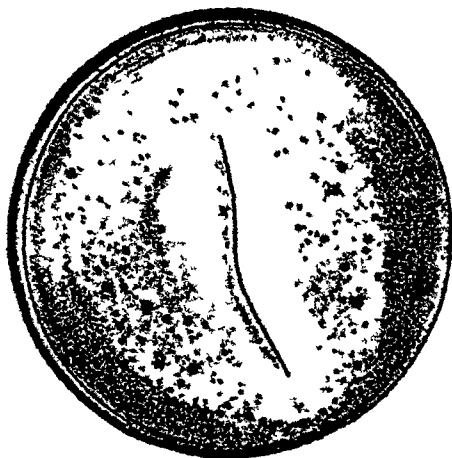
No 53 Agar infected with *Bacillus coli*, with von Bergmann gut on top



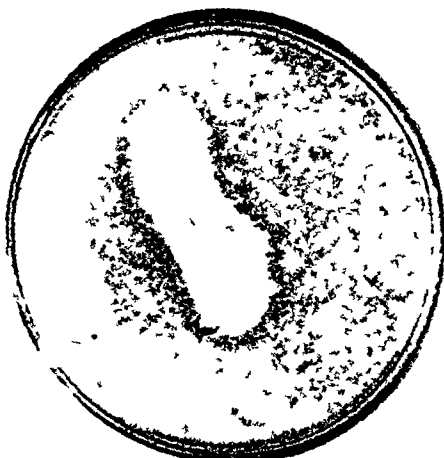
No 54 Agar infected with *Staphylococcus aureus*, with iodine gut on top



No 55 Agar infected with *Staphylococcus aureus*, with von Bergmann gut on top



No 111 Agar infected with *Bacillus anthracis*, with iodine gut on top

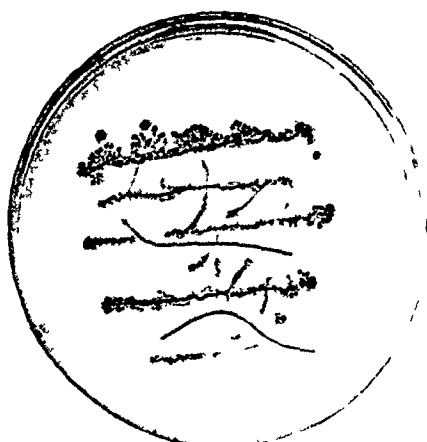


No 112 Agar infected with *Bacillus anthracis*, with von Bergmann gut on top





No 56 Smears of *Bacillus coli* on agar, with iodine gut on top



No 57 Smears of *Bacillus coli* on agar, with von Beigmann gut on top



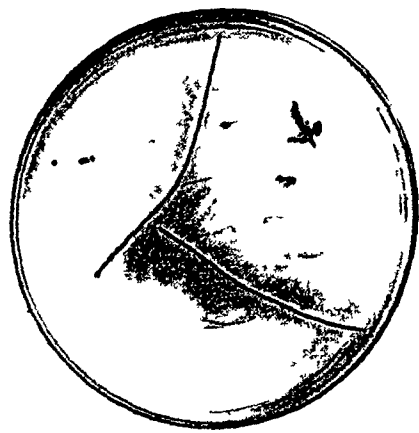
No 58 Smears of *Staphylococcus aureus* on agar, with iodine gut on top



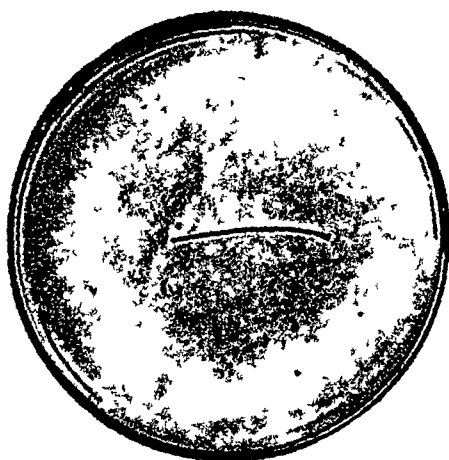
No 59 Smears of *Staphylococcus aureus* on agar, with von Bergmann gut on top



No 69 Smears of *Staphylococcus aureus* on agar, with von Bergmann gut on top



No 68 Smears of *Staphylococcus aureus* on agar, with iodine gut on top



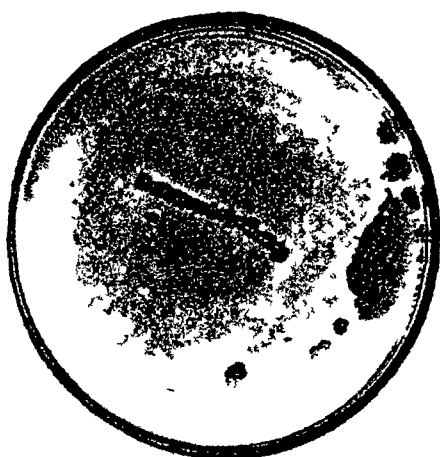
No 74 Iodine gut infected with *Staphylococcus aureus* "dry" on agar



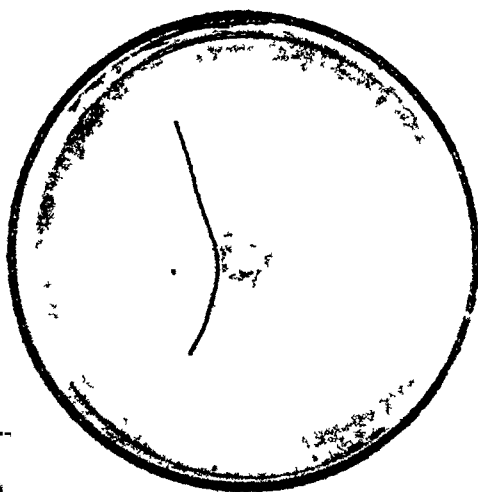
No 75 Von Bergmann gut infected with *Staphylococcus aureus* "dry" on agar



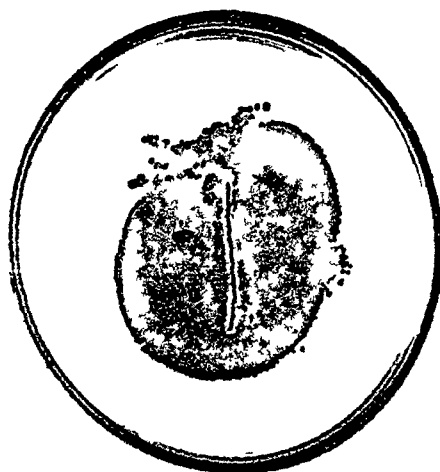
No 127 Iodine gut infected with *Bacillus anthracis* "dry" on agar



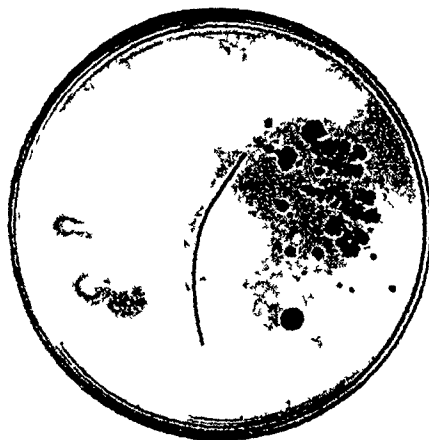
No 128 Von Bergmann gut infected with *Bacillus anthracis* "dry" on agar



No 129 Iodine gut infected with *Bacillus subtilis* "dry" on agar



No 130 Von Bergmann gut infected with *Bacillus subtilis* "dry" on agar



No 93 Smears of *Bacillus anthracis* on agar, with iodine gut on top



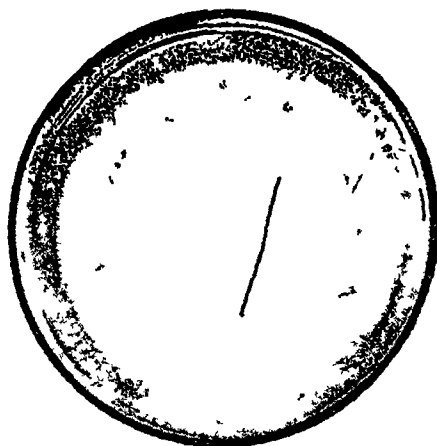
No 94 Smears of *Bacillus subtilis* on agar, with von Bergmann gut on top



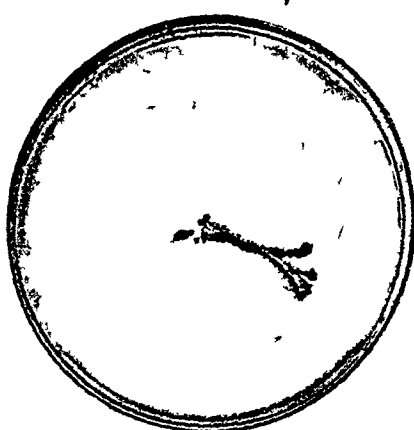
No 95 Smears of *Bacillus subtilis* on agar, with iodine gut on top



No 96 Smears of *Bacillus subtilis* on agar, with von Bergmann gut on top



No 72 Iodine gut infected with *Bacillus coli* "dry" on agar



No 73 Von Bergmann gut infected with *Bacillus coli* "dry" on agar

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### THE STAGE OF EXHAUSTION

In the treatment of alcoholism and dipsomania the physician is called to the case at the stage of exhaustion or prostration and a general derangement of nearly every function. Neurosis, cerebral congestion, cardiac acceleration, gastric and mesenteric disturbance, nausea, retching, intolerance of food, intense irritation, insomnia, and an endless variety of morbid sequelae require prompt attention.

It will be found that Antikamnia in combination with codeine will give a most prompt and satisfactory response in relieving all the array of symptoms so distressing and usually so obstinate as to defy all ordinary therapeutical interference. The best method is to administer one Antikamnia and Codeine Tablet (antikamnia gr 43, codeine gr 1) every fifteen minutes to a half hour, until three are taken, then widen the interval to one and a half to two hours, according to the urgency of the symptoms. Under this treatment the circulation will modify, the cardiac pains subside, the tremor, anxiety, and morbid vigilance will give way to rest, quiet, calm, and peaceful sleep. The nausea and vomiting, together with the irritable coughs which so frequently characterize these cases, will all disappear.

The superior results obtained with "Antikamnia and Codeine Tablets" are due, in a great measure, to the fact that the manufacturers refine and purify all of the codeine which enters into these tablets, and this prevents the constipation, depression, and habit which frequently follow the administration of preparations containing ordinary commercial codeine.

### A NEW LIQUID ANTISEPTIC

Parke, Davis & Co have recently introduced a new liquid antiseptic of considerable power, called Cresylone. It contains fifty per cent of cresylic acid and forms clear solutions with water in all proportions.

A two per cent solution of Cresylone is not only an excellent disinfectant for instruments and hands, but a valuable detergent and lubricant, too. It is said not to injure metallic or rubber instruments, though celluloid articles are apt to become friable under its action.

In the treatment of wounds a one per cent solution is usually employed, and a two per cent solution may be used in profoundly septic cases when more vigorous measures are indicated.

Cresylone completely arrests the development of pus organisms, and is therefore, indicated in the various suppurations with which the general practitioner has to contend. In the treatment of otorrhoea, irrigation with a one-half per cent solution is said to be of benefit. A solution of the same strength is of value in the treatment of ozæna.

As it removes odor, it may prove of service in gangrene. In cancer of the cervix uteri the application of gauze saturated with a solution of Cresylone will remove the odor that accompanies this disease. For disinfecting sputa and stools Cresylone commends itself in the sick-room, hospital ward, schools, prisons, etc.

Therapeutically, the use of Cresylone has been suggested in various pathologic conditions, notably in the treatment of gonorrhoea, lupus, tonsillitis, eczema, and cystitis of the female.

## BETA-EUCAIN LACTATE

THOMAS J. HARRIS, M.D., Surgeon Post-Graduate Hospital, Throat Department, Assistant Surgeon Manhattan Eye and Ear Hospital, New York, read a paper on "Beta-Eucain Lactate as an Anæsthetic for Operations in the Nose and Throat" before the New York Academy of Medicine, Section of Rhinology, April 26, 1905. He quoted from a recent paper of Lemaire the numerous forms of intoxication which may occur from the local use of cocaine, and recounted several cases in his own practice where disagreeable results had followed. The possibility of such accidents justifies the study of any drug possessing the anæsthetic effect of cocaine without its unpleasant actions. He has, therefore, for several months tested beta-eucain lactate in solutions of different strengths. The impression gained is that it is an excellent substitute for cocaine and may be used in the strongest solutions without fear of toxic symptoms. It does not lose its anæsthetic qualities under the usual periods of office use. It does not seem that its anæsthetic power is quite as great as cocaine's, and in the more painful operations on the nose it is best used in correspondingly stronger solution.

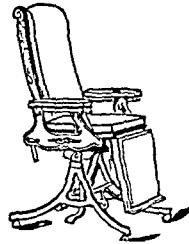
Dr. Wilson said in the discussion that he wished to add his testimony to the efficacy of eucain lactate. Dr. Harris called his attention to it about a month ago and since then he has used it freely. There were certain operations in which cocaine had marked advantages. Eucain lactate has its places, however, especially in the larynx. He has used it a great deal in introducing a canula into the trachea and it produced none of the disagreeable choking effects following the use of cocaine. In his practice, however, its main advantage had been obtained in the eye. It does not dilate the pupil and gives a marked anesthesia of the cornea—Abstracted from the *Laryngoscope*, June, 1905.

## LUNG ANTISEPTICS

The recent announcement of the discovery of an intestinal antiseptic capable of killing all bacterial life in the intestine without injury to the intestine itself is a great step in advance, and if true means the elimination of typhoid fever, dysentery, and other bowel inflammations. If, now, some scientist would only discover an antiseptic that would ex-

terminate all bacteria in the lungs without injury to the lungs, so that the matter of consumption could be met and the dreadful mortality due to that disease removed, physicians would feel that human agencies were far advanced toward their limits in conquering disease.

Until such a lung antiseptic is discovered physicians must go on, and by purely defensive measures, by nourishing, strengthening, protecting, and putting the consumptive's body into the best possible physical condition try to attain that "power of resistance" which repulses the invasion of disease. Among the potent medicinal agencies for attaining this "power of resistance," cod-liver oil occupies a most prominent position. Scott's Emulsion, the well-known proprietary preparation of cod-liver oil, owes its prominence to the truly remarkable effects of the oil in supplying the consumptive with an easy means of nourishment and a saving of his vitality.



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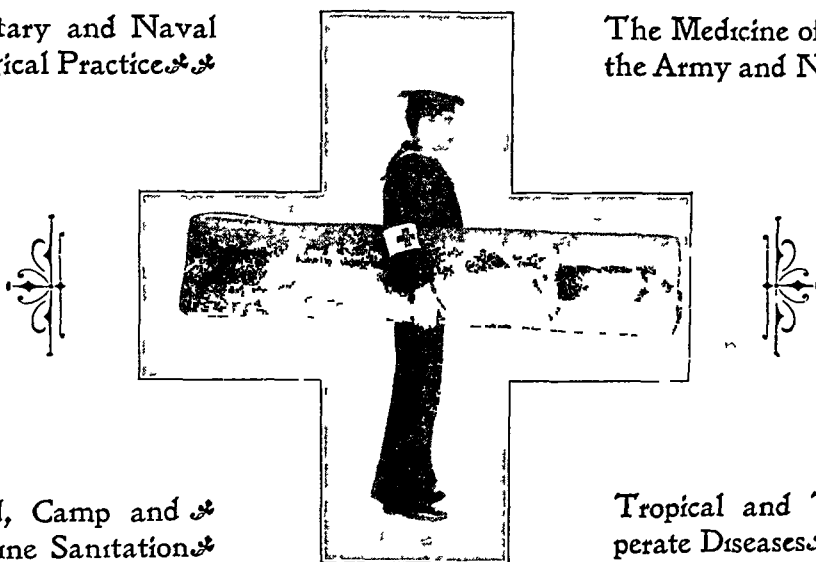
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James Evelyn Pilcher, M.D., Ph.D., L.H.D.,

Major and Brigade Surgeon of United States Volunteers,  
Captain, Retired, in the United States Army

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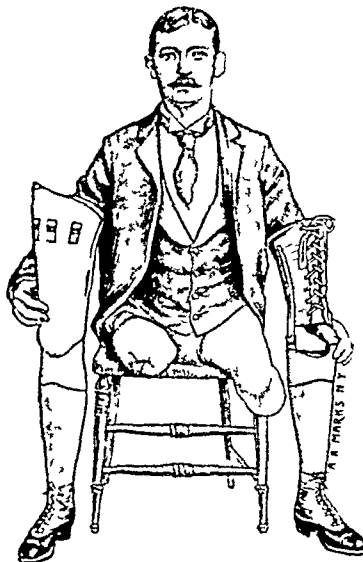
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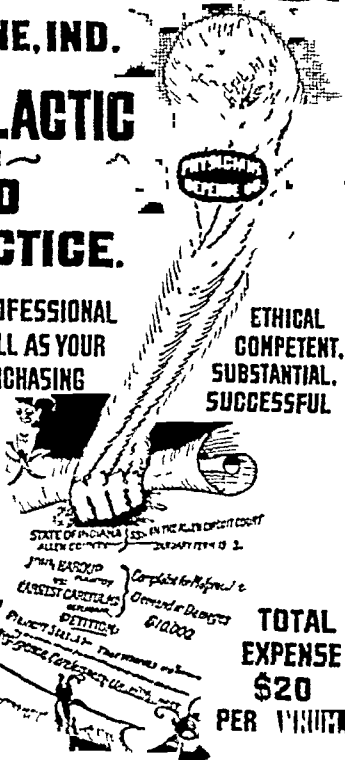
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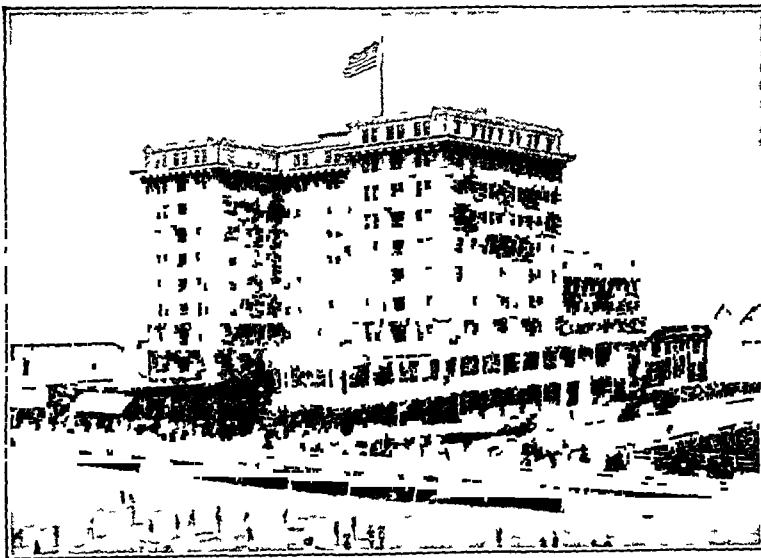
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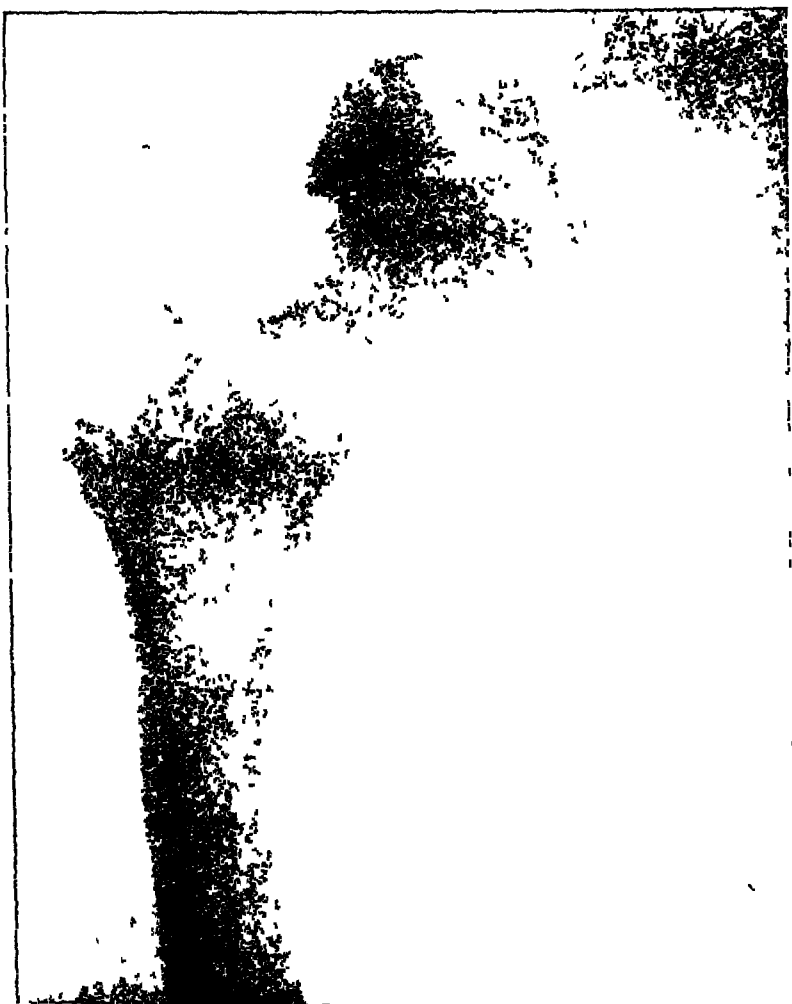
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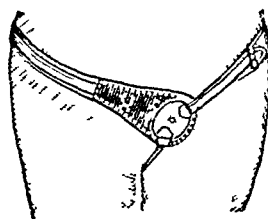
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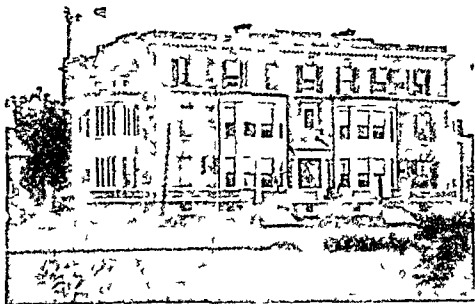


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It is believed that Psychiatry is a science whose ultimate aim is to increase the brain power of the nation, and it is the expectation that this work will stimulate the interest of the students of Psychiatry. The same methods that are employed in other departments of medical science can be used in studying the so-called mental diseases, as they are but a branch of general medicine. It is particularly desirable that general practitioners should early recognize and begin the treatment of these cases, as much better results can be obtained if taken in their incipency than if allowed to remain untreated until it is necessary to place the patient in an institution for the insane. The book is written entirely from this stand-point, as the author's experience and practical observation was gathered in the dispensary and wards of the Johns Hopkins Hospital, as well as the Sheppard and Enoch Pratt. Thus he has been enabled to begin treatment when there is most hope for a favorable outcome, and particular emphasis has been given to the early symptoms that appear as the time when the cases are seen by the general practitioner. Treatment is discussed in a separate chapter, as well as in the sections devoted to the different diseases. The relation of the pathological changes to the disease processes is also the subject of a separate section, and is likewise referred to more particularly in connection with the individual disturbances. In the discussion of the symptomatology the attempt has been made to present the subject in a manner that will be of interest to the physiologist and psychologist as well as to the practicing physician. The important bearing that the newer conceptions have upon the so-called problem of the will and the question of individual responsibility is discussed. The special causes of alienation form the subject of a chapter, particular reference having been made to the relation of the various functional and organic diseases to alienation, for example, the relation of renal, hepatic, and cardiac diseases to mental disorders. The illustrations are unique, interesting, and instructive.

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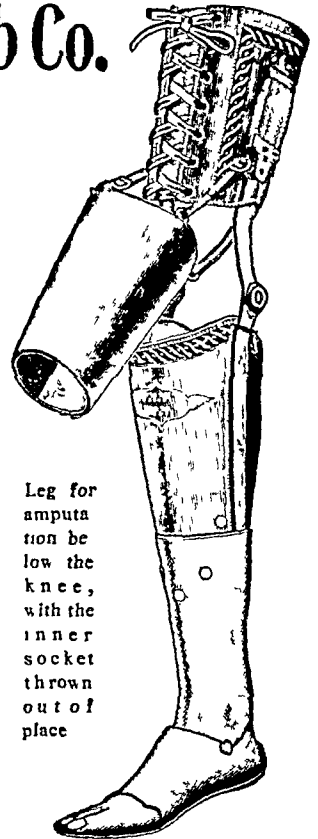
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## ORIGINAL MEMOIRS.

### DRY IODINE CATGUT<sup>1</sup>

BY ALEXIS V MOSCHCOWITZ, M D,

OF NEW YORK,

Adjunct Attending Surgeon, Mount Sinai Hospital

*(From the Pathological Laboratory of the College of Physicians and Surgeons, Columbia University, New York)*

ABOUT one year ago I presented to the Surgical Section of the New York Academy of Medicine a brief report<sup>1</sup> on Claudius's catgut, in which I pointed out its advantages over catgut prepared by other methods. This method of preparation was soon adopted by surgeons in various parts of the country, and it was not long before I received various complaints concerning its tensile strength and it is but proper to confess that, though we continued to use it, we also found that this complaint was not entirely without foundation. Its other advantages were, however, so preponderating, that, though not satisfactory in all details, we were loath to abandon it entirely, and I therefore set myself the task to find, and if possible to eliminate, the causes of this loss of strength. I soon became convinced that this was due only to its long-continued immersion in the iodine solution. In other words, no change was necessary in the preparation of the catgut, but one was indi-

<sup>1</sup> Read before the Surgical Section of the New York Academy of Medicine, May 5, 1905

cated in its subsequent preservation. According to Claudius's directions, the catgut was preserved in the original iodine solution for an indefinite time. I have changed these directions in so far that I remove the catgut from the iodine solution at the end of eight days, and thereafter keep it dry and ready for use in a sterile vessel. This step, however, be it ever so simple, involved to my mind a material departure from Claudius's method, and it was necessary therefore to again subject the dry catgut to an investigation of the attributes required of good catgut, and it is the object of this paper to present the results of my research.

As I pointed out in my original article, the four cardinal attributes which must be present in an ideal catgut are, (1) It should be absolutely sterile, (2) in the course of preparation it should not lose any of its tensile strength, (3) it should be readily and simply prepared, and without any undue expense, and (4) it should be absorbed completely, but only after it has served the purposes for which it was intended.

I. STERILITY.—Dr Arpad G. Gerster and myself have used in the First Surgical Division of Mount Sinai Hospital as a routine procedure catgut prepared by means of iodine solution for nearly three years, during the past nine months after the modified method, and in no case have we had the slightest occasion for regretting our confidence in it. What is of practical interest at the present time is our experience with the newer catgut, and I can only say, that during the time mentioned we have used it in every instance where the use of catgut was indicated, not only as ligature, but also as suture material, and at no time did we see any untoward effects from it.

As already stated, the method now in use is to my mind an important departure from the original method of Claudius. Sufficient evidence for the sterility of catgut prepared by the Claudius method was presented by Claudius,<sup>2</sup> <sup>3</sup> Martina,<sup>4</sup> von Hippel,<sup>5</sup> and Johnson,<sup>6</sup> but it was necessary to examine the newer catgut also from a bacteriological stand-point. A few preliminary experiments were made for me by Dr Alfred Cohn, of the house staff of Mount Sinai Hospital, the detailed

experiments I was able to conduct at the Pathological Laboratory of the College of Physicians and Surgeons, Columbia University, through the courtesy of Dr T Mitchell Prudden, and I take great pleasure on this occasion to express my gratitude to Dr Prudden, not only for the many courtesies extended, but also for his valuable advice and for the interest shown in my work

At the outset, I would state that all of the experiments were conducted with No 1 iodine catgut, and that all of the experiments were controlled with catgut of similar size, prepared after the von Bergmann method

The various experiments conducted may be conveniently grouped under the following headings

A *Tests to prove the sterility of the catgut*

B *Tests to show the effect of catgut on growing cultures*

C *Tests to show the effect of infected catgut*

A *Tests to prove the Sterility of the Catgut*—These experiments were conducted in the following manner Pieces of iodine catgut and of von Bergmann catgut, about one inch in length, were placed in the following media Bouillon, gelatin (previously liquefied and poured into a Petri dish), agar-agar (previously liquefied and poured into a Petri dish), and serum-bouillon, the gelatin plates were kept at room-temperature, the remainder in the thermostat, and all were observed from day to day for about two weeks

Following is an account of these experiments

EXPERIMENT 1—December 30 Iodine gut planted into bouillon December 31, no growth January 1, no growth Observations taken until January 14, up to which date there was not the slightest clouding of the medium noted

EXPERIMENT 2—December 30 Von Bergmann catgut planted into bouillon December 31, no growth January 2, growth, as shown by cloudiness of the medium Observations taken until January 14, but no further change noted

EXPERIMENT 3—December 30 Gelatin was liquefied and poured into a Petri dish, after solidification, a piece of iodine gut was placed upon it December 31, no growth, nor at any time until January 7, when further observation was discontinued

EXPERIMENT 4—December 30 Gelatin was liquefied and poured into

a Petri dish, after solidification, a piece of von Bergmann catgut was placed upon it December 31, no growth January 2, no growth January 3, one colony at great distance from the catgut (Accidental contamination) Observations taken until January 7, but no further change noted

EXPERIMENT 5—Agar-agar was liquefied and poured into a Petri dish, after solidification, a piece of iodine gut was placed upon it December 31, no growth January 2, no growth, nor at any time until January 10, when further observation was discontinued

EXPERIMENT 6—December 30 Agar-agar was liquefied and poured into a Petri dish, after solidification, a piece of von Bergmann catgut was placed upon it December 31, no growth January 2, no growth, nor at any time until January 10, when further observation was discontinued

EXPERIMENT 7—December 30 Equal parts of hydrocele-serum and bouillon were mixed, and into this mixture a piece of iodine gut was placed December 31, no growth, nor at any time until January 14, when further observation was discontinued

EXPERIMENT 8—December 30 Equal parts of hydrocele-serum and bouillon were mixed in a test-tube, and into this mixture a piece of von Bergmann catgut was placed December 31, no growth Observations taken until January 10, when the medium became turbid, and remained so until January 14, when further observations were discontinued

EXPERIMENT 9—December 31 Repetition of Experiment 1, remained sterile until January 14, when further observation was discontinued

EXPERIMENT 10—December 31 Repetition of Experiment 2 January 2, no growth January 3, medium turbid Observations taken until January 14, but no further change noted

EXPERIMENT 11—December 31 Repetition of Experiment 3, remained sterile until January 10, when further observation was discontinued

EXPERIMENT 12—December 31 Repetition of Experiment 4 January 2, growth beginning at one end of the catgut, and therefore might be looked upon as a contamination January 3, the entire plate was overgrown Observations continued until January 7, but no further change noted

EXPERIMENT 13—December 31 Repetition of Experiment 5, remained sterile until January 10, when further observation was discontinued

EXPERIMENT 14—December 31 Repetition of Experiment 6, remained sterile until January 10, when further observation was discontinued

EXPERIMENT 15—December 31 Repetition of Experiment 7, remained sterile until January 14 when further observation was discontinued

EXPERIMENT 16—December 31 Repetition of Experiment 8, re-

remained sterile until January 14, when further observation was discontinued

It might be argued by some that the iodine catgut, owing to its imbibition with iodine, is so powerful that in a measure it sterilizes the comparatively small amount of bouillon in a test-tube, to refute this argument, I have a number of times repeated the above experiments with iodine gut, but used for each experiment a much larger quantity (60 cubic centimetres) of bouillon, but in no instance did I obtain a growth

In summing up these sixteen experiments, it is at once evident that all the tests made with the iodine gut remained sterile, some of the tests made with the von Bergmann catgut showed a growth, notably those made with bouillon (Experiments 2 and 10) The von Bergmann catgut is not on trial here, but in view of these tests it certainly shows an inferiority Suffice it to say that these experiments justify at least the positive conclusion that the iodine catgut is sterile

### *B Tests to show the Effect of the Catgut on growing Cultures*

EXPERIMENT 52—January 10 A tube of agar-agar was liquefied, infected with *Bacterium coli*, and poured into a Petri dish After solidification, a piece of iodine catgut was placed upon it January 11, numberless colonies developed, but none in a space three-quarters of an inch wide surrounding the catgut January 12, the only change noted was an increase in the size of some of the colonies at the margin of the clear space Observations taken until January 16, but no further change noted (See illustration)\*

EXPERIMENT 53—January 10 A tube of agar-agar was liquefied, infected with *Bacterium coli*, and poured into a Petri dish After solidification, a piece of von Bergmann catgut was placed upon it January 11, growth everywhere upon the plate, except in a space about three-sixteenths of an inch in width surrounding the catgut Observations taken until January 16, but no further change noted (See illustration)

EXPERIMENT 54—January 10 A tube of agar-agar was liquefied, infected with *Staphylococcus aureus*, and poured into a Petri dish After solidification, a piece of iodine gut was placed upon it January 11, numberless colonies upon the plate, except in a space about two inches wide surrounding the catgut Observations taken until January 16, but no

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\* Dr Edward Leaming was kind enough to make for me the photographs accompanying this article, for which I wish to express my thanks also on this occasion



material change noted, excepting an increase in the size of the colonies near the margin of the clear space (See illustration)

EXPERIMENT 55—January 10 A tube of agar-agar was liquefied, infected with *Staphylococcus aureus*, and poured into a Petri dish After solidification, a piece of von Bergmann catgut was placed upon it January 11, numberless colonies everywhere, excepting in a space about one-eighth of an inch in width surrounding the catgut Observations taken until January 16, but no further change noted (See illustration)

EXPERIMENT 60—January 10 A tube of gelatin was liquefied, infected with *Bacterium coli*, and poured into a Petri dish After solidification, a piece of iodine gut was placed upon it January 11, no growth January 12, numerous colonies, excepting in a space about two inches wide surrounding the catgut Observation continued until January 16, but no further change noted

EXPERIMENT 61—January 10 A tube of gelatin was liquefied, infected with *Bacterium coli*, and poured into a Petri dish After solidification, a piece of von Bergmann catgut was placed upon it January 11, numberless colonies everywhere, excepting in a space about one-quarter of an inch wide surrounding the catgut, and even here a few isolated colonies are to be seen with the microscope Observations taken until January 16, but no further change noted except an increase in the size of some of the colonies

EXPERIMENT 62—January 10 A tube of gelatin was liquefied, infected with *Staphylococcus aureus*, and poured into a Petri dish After solidification, a piece of iodine catgut was placed upon it January 11, no growth January 12, numerous colonies, excepting a space about two inches wide surrounding the catgut Observations taken until January 16, but no further change noted

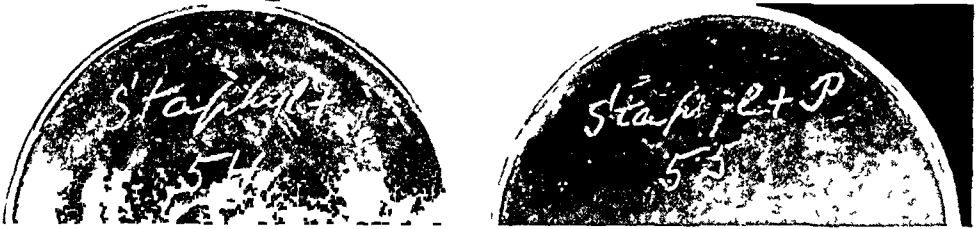
EXPERIMENT 63—January 10 A tube of gelatin was liquefied, infected with *Staphylococcus aureus*, and poured into a Petri dish After solidification, a piece of von Bergmann catgut was placed upon it January 11, no growth January 12, numerous colonies, except in a space about one-quarter of an inch in width surrounding the catgut January 13, colonies almost up to the catgut Observations taken until January 16, but no further change noted

EXPERIMENT III—January 16 A tube of agar-agar was liquefied, infected with *Bacillus anthracis*, and poured into a Petri dish After solidification, a piece of iodine gut was placed upon it January 17, numerous colonies, but none within two and one-quarter inches of the catgut January 18, a large number of isolated colonies developed within the space previously clear, but none within a space of one inch surrounding the catgut Observations taken until January 21, but no further change noted (See illustration)

EXPERIMENT 112—January 16 A tube of agar-agar was liquefied, infected with *Bacillus anthracis*, and poured into a Petri dish After solidification, a piece of von Bergmann catgut was placed upon it January 17, numerous colonies, excepting in a space about one-half inch wide,



- No 52 Agar infected with *Bacillus coli* with iodine gut on top  
 No 53 Agar infected with *Bacillus coli*, with von Bergmann gut on top



- No 54 Agar infected with *Staphylococcus aureus*, with iodine gut on top  
 No 55 Agar infected with *Staphylococcus aureus*, with von Bergmann gut on top



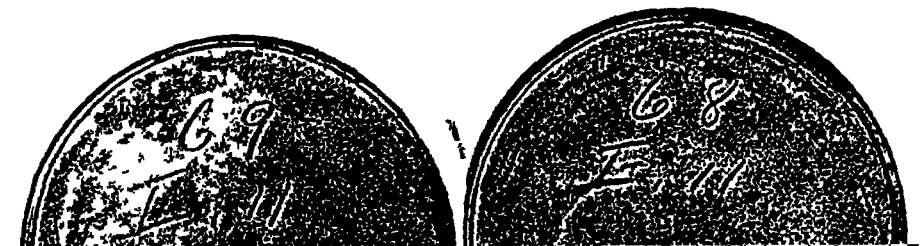
- No 111 Agar infected with *Bacillus anthracis*, with iodine gut on top  
 No 112 Agar infected with *Bacillus anthracis*, with von Bergmann gut on top



- No 56 Smears of *Bacillus coli* on agar, with iodine gut on top  
 No 57 Smears of *Bacillus coli* on agar, with von Bergmann gut on top



- No 58 Smears of *Staphylococcus aureus* on agar with iodine gut on top  
 No 59 Smears of *Staphylococcus aureus* on agar with von Bergmann gut on top



- No 68 Smears of *Staphylococcus aureus* on agar with iodine gut on top  
 No 69 Smears of *Staphylococcus aureus* on agar with von Bergmann gut on top



- No 93 Smears of *Bacillus anthracis* on agar with iodine gut on top  
 No 94 Smears of *Bacillus subtilis* on agar with von Bergmann gut on top



- No 95 Smears of *Bacillus subtilis* on agar with iodine gut on top  
 No 96 Smears of *Bacillus subtilis* on agar, with von Bergmann gut on top

surrounding the catgut Observations taken until January 21, but only a slight extension of the colonies noted (See illustration)

EXPERIMENT 113—January 16 A tube of agar-agar was liquefied, infected with *Bacillus anthracis*, and poured into a Petri dish After solidification, a piece of iodine catgut was placed upon it January 17, numerous colonies, but none within one and three-quarters inches of the catgut January 18, a few scattered colonies around the margin of the space previously clear, but still there are no colonies within one inch of the catgut Observations taken until January 21, but no further change noted, excepting an increase in the size of some of the superficial colonies

EXPERIMENT 114—January 16 A tube of agar-agar was liquefied, infected with *Bacillus subtilis*, and poured into a Petri dish After solidification, a piece of von Bergmann catgut was placed upon it January 17, numerous colonies, but none within a space, about one-third of an inch wide, surrounding the catgut Observations taken until January 21, but no further change noted

EXPERIMENT 91—January 14 A tube of agar-agar was liquefied, infected with *Streptococcus pyogenes*, and poured into a Petri dish After solidification, a piece of iodine catgut was placed upon it January 15, a few colonies to be seen with the microscope, but only at the margins of the Petri dish Observations taken until January 21, but no further change noted

EXPERIMENT 92—January 14 A tube of agar-agar was liquefied, infected with *Streptococcus pyogenes*, and poured into a Petri dish After solidification, a piece of von Bergmann catgut was placed upon it January 15, numerous colonies to be seen with the naked eye and microscope, but none in a space about one-half inch wide surrounding the catgut Observations taken until January 21, but no further change noted

EXPERIMENT 56—January 10 Smears of *Bacterium coli* were made upon agar solidified in a Petri dish, upon these a piece of iodine gut was placed January 11, numerous colonies, but none anywhere near the catgut January 12, the colonies are larger than on January 11, but there is no extension towards the catgut Observations taken until January 16, but no further change noted (See illustration)

EXPERIMENT 57—January 10 Smears of *Bacterium coli* were made upon agar solidified in a Petri dish, upon these a piece of von Bergmann catgut was placed January 11, growth on all smears almost up to the catgut, though not quite in contact with it Observations taken until January 16, but only an increase in the size of the colonies noted (See illustration)

EXPERIMENT 58—January 10 Smears of *Staphylococcus aureus* were made upon agar solidified in a Petri dish, upon these a piece of iodine gut was placed January 11, growth on all smears distant from the catgut, but none anywhere near it Observations taken until January 16, but only an increase in the size of the colonies noted (See illustration.)

EXPERIMENT 59—January 10 Smears of *Staphylococcus aureus* were made upon agar solidified in a Petri dish, upon these a piece of von

Bergmann catgut was placed January 11, growth on all smears, almost up to the catgut, but not quite in contact with it January 12, increase in the size of the colonies, and their extension towards the catgut was noted, so as to be almost in contact with it Observations taken until January 16, but only an increase in the size of the colonies noted (See illustration)

EXPERIMENT 66—January 11 is a repetition of Experiment 56, and is inserted here merely on account of the perfect illustration, which see

EXPERIMENT 67—January 11 is a repetition of Experiment 57, and is inserted here merely on account of the perfect illustration, which see

EXPERIMENT 68—January 11 is a repetition of Experiment 58, and is inserted here merely on account of the perfect illustration, which see

EXPERIMENT 69 January 11 is a repetition of Experiment 59, and is inserted here merely on account of the perfect illustration, which see

EXPERIMENT 93—January 14 Smears of *Bacillus anthracis* were made upon agar solidified in a Petri dish, upon these a piece of iodine gut was placed January 15, a few colonies developed near the ends of the streaks, but none anywhere near the catgut Observations taken until January 21, but no further change noted (See illustration The colonies to the left of the catgut in this illustration are not of anthrax, but are accidental contaminations, developing sometime after the experiment)

EXPERIMENT 94—January 14 Smears of *Bacillus anthracis* were made upon agar solidified in a Petri dish, upon these a piece of von Bergmann catgut was placed January 15, abundant growth on all streaks up to one-quarter of an inch from the catgut Observations taken until January 21, but only an increase in the size of the colonies noted (See illustration)

EXPERIMENT 95—January 14 Smears of *Bacillus subtilis* were made upon agar solidified in a Petri dish, upon these a piece of iodine gut was placed January 15, growth at both ends of the streaks, but none anywhere near the catgut Observations taken until January 21, but no further change noted (See illustration)

EXPERIMENT 96—January 14 Smears of *Bacillus subtilis* were made upon agar solidified in a Petri dish, upon these a piece of von Bergmann catgut was placed January 15, plate overgrown with extensive colonies in actual contact with the catgut Observations taken until January 21, but no further change noted (See illustration)

EXPERIMENT 97—January 14 Smears of *Streptococcus pyogenes* were made upon agar solidified in a Petri dish, upon these a piece of iodine gut was placed January 15, a few colonies developed towards the ends of some of the streaks, all far away from the catgut Observations taken until January 21, but no further change noted

EXPERIMENT 98—January 14 Smears of *Streptococcus pyogenes* were made upon agar solidified in a Petri dish, upon these a piece of von Bergmann catgut was placed January 15, numerous colonies developed, but none nearer than one-half inch from the catgut Observations taken until January 21, but no further change noted

Even a hasty examination of the experiments just related, and particularly of the accompanying photographs, at once calls attention to two phenomena, first, the relatively large area, upon the plates made with iodine gut, which is free from any growth, more particularly when compared with the control plates made with von Bergmann catgut. It is, of course, difficult to express exactly in figures how much larger the area is around the iodine catgut than around the von Bergmann catgut, but I believe myself to be within safe limits if I judge that it is at least four times as great. Secondly, though relatively small, there is still an area free from growth also surrounding the von Bergmann catgut. It is self-evident that the large area surrounding the iodine catgut is due to the powerful antiseptic properties of the free iodine contained therein, and it was but natural to assume some similar agent, *e g*,  $\text{HgCl}_2$  was also present in the von Bergmann catgut. Dr Bookman, physiological chemist of Mount Sinai Hospital, was kind enough to undertake for me a chemical analysis. He found that one yard of No. 1 catgut prepared by the von Bergmann method contained an amount of mercury which would be equivalent to 0.008825 of  $\text{HgCl}_2$ , this will readily explain the relatively small sterile area upon the plates.

I am particularly pleased to acknowledge this work of Dr Bookman, as at first I was at a loss to account for the non-appearance of any growth in the plates made with the von Bergmann catgut. I personally was always under the impression that in the von Bergmann catgut we are dealing with an aseptic catgut, and not with an antiseptic catgut, but the results obtained in the chemical analysis prove the contrary. It appears that the bichloride of mercury used in the preparation of the catgut enters into a chemical combination with the organic substances, probably some form of albuminate, which evidently has antiseptic properties as well.

It is patent to everybody that the sterility of the iodine catgut is due to the antiseptic action of the iodine contained therein, but it was of interest to me, also, to know just how much iodine was contained in a given piece of iodine catgut.

Analysis by Dr Bookman revealed the presence of 0.025737 of iodine in one yard of No. 1 iodine catgut. If it is recollected that a 1 to 5000 aqueous solution of iodine is still a very powerful antiseptic, it will be seen that one and one-half inches of No. 1 catgut will be amply sufficient to render absolutely sterile 8 cubic centimetres of medium, the amount generally used for bacteriological purposes.

It might, and with a certain amount of justice, be argued that in the experiments just related, the iodine exerts merely an inhibitory action upon the development of the bacteria, and that there are still numerous active and living bacteria in the clear area surrounding the catgut, which are only temporarily prevented from developing, but which would still develop when placed in more favorable surroundings. In order to disprove such a possibility, I have made the following experiments.

EXPERIMENT A. EXPERIMENT 162—January 29. A tube of liquefied agar-agar was inoculated with a virulent culture of *Bacillus anthracis*, and poured into a Petri dish. After solidification, a piece of iodine catgut was placed upon it. January 30, numerous colonies developed, but none in an area extending over one inch on either side of the catgut. February 1, no further change noted.

EXPERIMENT 164—January 30. A liberal inoculation was made from the clear agar surrounding the iodine catgut in Experiment 162, and about one-half inch away from it, into bouillon. January 31, no growth. Observations taken until February 5, but no further change noted.

EXPERIMENT 166—January 30. Repetition of Experiment 164 in agar and Petri dish also gave a negative result.

But even this series of experiments may not be considered absolutely conclusive, as it might be argued that the conditions with the bouillon in Experiment 164, or with the agar in Experiment 166, were still not sufficiently favorable for the development of the anthrax bacilli. I therefore supplemented them with the following animal experiment.

EXPERIMENT 172—February 4. After proper preparation and antiseptic precautions, a small incision was made upon the back of a guinea-pig, and with dressing-forceps a small pocket was prepared. Into this there was buried a piece of the clear agar surrounding the catgut in Experiment 162, about one-half inch square and about one-sixteenth

of an inch thick February 5, no reaction February 11, animal still alive and perfectly well

Surely in this test all the conditions favorable for the development of any bacteria were present, and if the high virulence of the particular anthrax culture used be considered, we must assume that death of the animal should have followed, provided there were still living, though undeveloped, bacteria in the clear space surrounding the catgut

In corroboration of this fact, I might also adduce the argument that all of my plates were observed for a number of days in the thermostat, and that I have found that already after twenty-four hours, owing to the temperature of the thermostat, and owing to the chemical affinity free iodine has for the various salts contained in the nutritive media, the catgut has lost its black color, nor could I get the well-known reaction for iodine with starch. It follows therefore that any agency which the iodine may have upon the non-development of bacteria must be exerted in the beginning, assuming merely an inhibitory action, this would certainly cease after the iodine has been driven off by volatilization, but as no bacteria develop in the clear space even after long-continued observation, we must come to the conclusion that the iodine acts not merely as an inhibitory agent, but as a true bactericide

I know full well that the human body is not a culture tube nor a guinea-pig, and that numerous other conditions, which exist in the human body and not in the Petri dish, must be taken into account, but I believe we may safely deduct this much from this series of experiments, namely, that the iodine catgut will, at least in a measure, assist in neutralizing accidental infections in wounds

*C Tests to show the Effects of Infected Catgut*—I now come to the most interesting series of my experiments,—interesting because they were entirely unlooked for and surprising, and also because they are so very important from the surgeon's stand-point. This series of experiments goes to prove in a bacteriological sense that the iodine catgut is practically non-infectible. The importance of this point will be readily appre-



ciated when it is remembered that accidental contact-infections of the catgut are so manifoldly possible, that a careful supervision of any operation goes to show that these accidental contact-infections, in spite of all care to eliminate them, are not only not exceptional, but the rule. The surgeon's and assistants' hands, as well as the skin of the patient, can never be rendered absolutely sterile, but only relatively so. The surgeon and assistants may even avoid direct contact with the catgut by wearing rubber gloves, but the skin of the patient cannot be so protected, and yet the catgut, if used as a suture, must pass through it. This results, as we all know, in an occasional stitch abscess, and from time to time in more serious infections. I venture to say that even these may be eliminated with the aid of iodine catgut.

The method of procedure was the following. Bouillon cultures were made of the following actively growing bacteria: *Bacillus coli*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bacillus anthracis*, and *Bacillus subtilis*. This culture was kept in the thermostat for twenty-four hours. At the expiration of this time, when an abundant growth had resulted, the culture was divided into two halves, and poured into sterile Petri dishes, into one dish there were placed about one dozen pieces of iodine catgut, about one inch in length, and into the other a similar number of von Bergmann catgut of the same length. Both dishes were then replaced for another twenty-four hours into the thermostat. At this time the excess of culture medium was poured off, and various tests made with the catgut (in the experiments this is called "wet catgut"), the balance was replaced for another twenty-four hours into the thermostat, and another set of experiments was made with it (in the experiments this is called "dry catgut").

EXPERIMENT 43—January 5. Iodine gut infected with *Bacillus coli* "wet" planted into bouillon. January 6, no growth, nor at any time until January 14, when further observation was discontinued.

EXPERIMENT 44—January 5. Von Bergmann catgut infected with *Bacillus coli* "wet" planted into bouillon. January 6, growth. Observations taken until January 14, but no further change noted.

EXPERIMENT 45—January 5. Iodine gut infected with *Staphylococcus*

aureus "wet" planted into bouillon January 6, no growth, nor at any time until January 14, when further observation was discontinued

EXPERIMENT 46—January 5 Von Bergmann catgut infected with *Staphylococcus aureus* "wet" planted in bouillon January 6, growth Observations taken until January 14, but no further change noted

EXPERIMENT 115—January 17 Iodine gut infected with *Bacillus anthracis* "wet" planted in bouillon January 18, no growth, nor at any time until January 26, when further observation was discontinued

EXPERIMENT 116—January 17 Von Bergmann catgut infected with *Bacillus anthracis* "wet" planted into bouillon January 18, no growth January 19, growth Observations taken until January 26, but no further change noted

EXPERIMENT 117—January 17 Iodine gut infected with *Bacillus subtilis* "wet" planted in bouillon January 18, no growth, nor at any time until January 26, when further observation was discontinued

EXPERIMENT 118—January 17 Von Bergmann catgut infected with *Bacillus subtilis* "wet" planted in bouillon January 18, growth Observations taken until January 26, but no further change noted

EXPERIMENT 119—January 17 Iodine gut infected with *Streptococcus pyogenes* "wet" planted in bouillon January 18, no growth, nor at any time until January 26, when further observation was discontinued

EXPERIMENT 120—January 17 Von Bergmann catgut infected with *Streptococcus pyogenes* "wet" planted in bouillon January 18, growth Observations taken until January 26, but no further change noted

These ten experiments made with the two varieties of catgut, after having been literally soaked for twenty-four hours in a twenty-four-hour old culture of actively growing bacteria, show that the iodine content of the iodine catgut was sufficient at least to inhibit, if not destroy, the development of bacteria with which it came in contact, since all the experiments with the iodine catgut gave a negative result, while all the experiments with the von Bergmann catgut gave a positive result. As in actual practice, however, we are using the catgut dry, it was necessary to repeat all these experiments, also, with the dried catgut. Following were the results obtained

EXPERIMENT 47—January 6 Iodine gut infected with *Bacillus coli* "dry" planted in bouillon January 7, no growth, nor at any time until January 14, when further observation was discontinued

EXPERIMENT 48—January 6 Von Bergmann catgut infected with *Bacillus coli* "dry" planted in bouillon January 7, growth Observations taken until January 14, but no further change noted

EXPERIMENT 49—January 6 Iodine gut infected with *Staphylococcus*

aureus "dry" planted in bouillon January 7, no growth, nor at any time until January 14, when further observation was discontinued

EXPERIMENT 50—January 6 Von Bergmann catgut infected with *Staphylococcus aureus* "dry" planted in bouillon January 7, no growth January 8, growth Observations taken until January 14, but no further change noted

EXPERIMENT 121—January 18 Iodine gut infected with *Bacillus anthracis* "dry" planted in bouillon January 19, no growth, nor at any time until January 26, when further observation was discontinued

EXPERIMENT 122—January 18 Von Bergmann catgut infected with *Bacillus anthracis* "dry" planted in bouillon January 19, no growth January 20, no growth Observations taken until January 26, but no further change noted (The only negative experiment in the entire series!)

EXPERIMENT 123—January 18 Iodine gut infected with *Bacillus subtilis* "dry" planted in bouillon January 19, no growth, nor at any time until January 26, when further observation was discontinued

EXPERIMENT 124—January 18 Von Bergmann catgut infected with *Bacillus subtilis* "dry" planted in bouillon January 19, growth Observations taken until January 26, but no further change noted

EXPERIMENT 125—January 18 Iodine catgut infected with *Streptococcus pyogenes* "dry" planted in bouillon January 19, no growth, nor at any time until January 26, when further observation was discontinued

EXPERIMENT 126—January 18 Von Bergmann catgut infected with *Streptococcus pyogenes* "dry" planted in bouillon January 19, growth Observations taken until January 26, but no further change noted

I have repeated the experiments just related also with agar media, their object is merely to serve as a better object lesson The procedure was the following Agar-agar was liquefied and poured into Petri dishes After solidification, a piece of the dry catgut, infected according to the method before described was placed upon it, and the subsequent behavior noted Following was the result of these experiments

EXPERIMENT 72—January 12 Iodine gut infected with *Bacillus coli* "dry" placed upon agar January 13, no growth, nor at any time until January 17, when further observation was discontinued (See illustration)

EXPERIMENT 73—January 12 Von Bergmann catgut infected with *Bacillus coli* "dry" placed upon agar January 13, growth Observations taken until January 17, but no further change noted (See illustration)

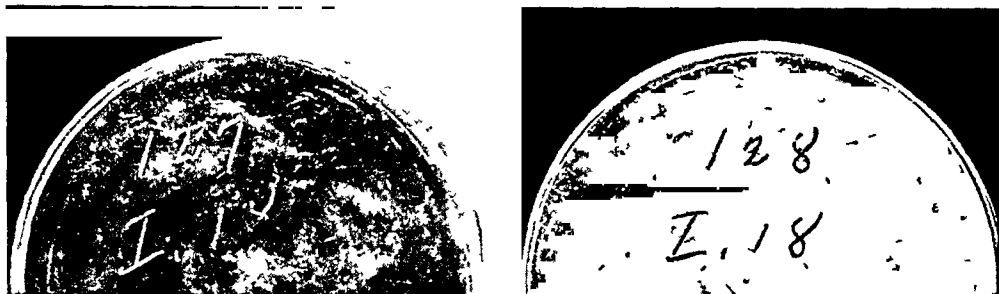
EXPERIMENT 74—January 12 Iodine gut infected with *Staphylococcus aureus* "dry" placed upon agar January 13, no growth, nor at any



No 72 Iodine gut infected with *Bacillus coli* "dry" on agar  
 No 73 Von Bergmann gut infected with *Bacillus coli* "dry" on agar



No 74 Iodine gut infected with *Staphylococcus aureus* "dry" on agar  
 No 75 Von Bergmann gut infected with *Staphylococcus aureus* "dry" on agar



No 127 Iodine gut infected with *Bacillus anthracis* "dry" on agar  
 No 128 Von Bergmann gut infected with *Bacillus anthracis* "dry" on agar



No 129 Iodine gut infected with *Bacillus subtilis* "dry" on agar  
 No 130 Von Bergmann gut infected with *Bacillus subtilis* "dry" on agar



time until January 17, when further observation was discontinued (See illustration)

EXPERIMENT 75—January 12 Von Bergmann catgut infected with *Staphylococcus aureus* "dry" placed upon agar January 13, growth Observations taken until January 17, but no further change noted (See illustration) (In this illustration the large colony at the upper end is an accidental mould, but the small, fine colonies along the lower end are typical staphylococci)

EXPERIMENT 127—January 18 Iodine gut infected with *Bacillus anthracis* "dry" placed upon agar January 19, no growth, nor at any time until January 26, when further observation was discontinued (See illustration No attention is to be paid to the accidental contamination to the right of this illustration, nor in the next illustration)

EXPERIMENT 128—January 18 Von Bergmann catgut infected with *Bacillus anthracis* "dry" placed upon agar January 19, no growth January 20, growth Observations taken until January 26, but no further change noted (See illustration)

EXPERIMENT 129—January 18 Iodine gut infected with *Bacillus subtilis* "dry" placed upon agar January 19, no growth, nor at any time until January 26, when further observation was discontinued (See illustration)

EXPERIMENT 130—January 18 Von Bergmann catgut infected with *Bacillus subtilis* "dry" placed upon agar January 19, growth Observations taken until January 26, but no further change noted (See illustration)

EXPERIMENT 131—January 18 Iodine gut infected with *Streptococcus pyogenes* "dry" placed upon agar January 19, no growth, nor at any time until January 26, when further observation was discontinued

EXPERIMENT 132—January 18 Von Bergmann catgut infected with *Streptococcus pyogenes* "dry" placed upon agar January 19, no growth January 20, growth Observations taken until January 26, but no further change noted

The thirty experiments last enumerated are of the utmost importance, because they more nearly approach the use of catgut in actual practice They show that at least, as far as the bacteriological test is concerned, the iodine catgut is far superior to the von Bergmann catgut, inasmuch as it is absolutely "uninfectible" All experiments with the iodine catgut gave an absolutely negative result, while with one exception (Experiment 122) all experiments made with the von Bergmann catgut gave a positive result Again, I would call attention to the fact that the living human organism is not a culture tube, and it would be wrong to transfer inferences from these test-tube and Petri dish experiments to the operating room, but

they certainly show this at least, that those constantly occurring, accidental, and unavoidable infections are of no harm if they occur with iodine catgut, while similar infections of the von Bergmann catgut may be productive of the greatest harm.

In addition to the above experiments, I have also made a few experiments with iodine gut after infecting it with pus from various sources. Of course, these experiments lose in actual value when compared with those just related, in which we deal with certain definite and positive infections, but they appeal perhaps more to the surgeon, as they deal with infections which might occur at any time in an operating room, or even in the course of an individual operation.

EXPERIMENT 51—January 10. On January 9 I had occasion to operate a metastatic empyema, caused by streptococci, the presence of which was verified both by slides and cultures. A basin of the pus was caught in a sterile vessel, and in it there was placed a spool of iodine catgut. After an immersion of six hours it was removed and placed into a sterile bottle, with large amounts of the pus still adhering to it. Fourteen hours later (*i.e.*, twenty hours after beginning the experiment) a piece of the catgut about one inch in length was planted into bouillon. January 11, no growth, nor at any time until January 16, when further observation was discontinued.

To refute the possible argument that in this as in other experiments the amount of iodine contained in the catgut was sufficient to render the small quantity of bouillon antiseptic, the following experiment was made.

EXPERIMENT 64—January 11. A piece of the catgut used in Experiment 51, about one inch in length, was planted into a large quantity (60 cubic centimetres) of bouillon, forty hours after the empyema operation. January 12, no growth, nor at any time until January 18, when further observation was discontinued.

EXPERIMENT 70—January 12. Iodine catgut was liberally smeared in the pus of a freshly opened furuncle of the neck (*staphylococcus* in spreads), and one hour later a piece one inch in length was planted into bouillon. January 13, no growth, nor at any time until January 18, when further observation was discontinued.

EXPERIMENT 71—January 12. Iodine catgut was liberally smeared in the pus of an axillary abscess (*staphylococcus* in spreads), and one hour later a piece one inch in length was planted into bouillon. January 13, no growth, nor at any time until January 18, when further observation was discontinued.

EXPERIMENT 76—January 13 The iodine gut used in Experiment 70 was allowed to remain in contact with the pus, and twenty-six hours later, by which time it had become perfectly dry, a piece one inch in length was planted into bouillon January 14, no growth, nor at any time until January 21, when further observation was discontinued

EXPERIMENT 77—January 13 The iodine gut used in Experiment 71 was allowed to remain in contact with the pus, and twenty-six hours later, by which time it had become perfectly dry, a piece one inch in length was planted into bouillon January 14, no growth, nor at any time until January 21, when further observation was discontinued

EXPERIMENT 78—January 13 Iodine gut was smeared in the pus of a freshly incised large periproctitic abscess, communicating by a fistulous tract with the rectum (numerous cocci and bacilli in spreads), and one hour later a piece one inch in length was planted into bouillon January 14, no growth, nor at any time until January 21, when further observation was discontinued

EXPERIMENT 80—January 14 The iodine gut used in Experiment 78 was allowed to remain in contact with the pus for twenty-five hours, by which time it had become perfectly dry, and a piece one inch in length was planted into bouillon January 15, no growth, nor at any time until January 21, when further observation was discontinued

EXPERIMENT 82—January 14 Iodine gut was smeared into the pus of a freshly incised suppurative arthritis of the elbow-joint, and one hour later a piece one inch in length was planted into bouillon January 15 no growth, nor at any time until January 21, when further observation was discontinued

On this occasion I repeated the experiment also with von Bergmann catgut, and, as was to be expected, obtained a positive result

EXPERIMENT 83—January 14 Von Bergmann catgut was smeared into the pus of a freshly incised suppurative arthritis of the elbow-joint, and one hour later a piece one inch in length was planted into bouillon January 15, growth

In addition, I have made numerous experiments in the following manner Pieces one inch in length were cut with an ordinary old unsterilized pair of scissors, from spools of iodine catgut, which had lain some time for months in a not overclean laboratory drawer, and planted into bouillon, but at no time was a growth obtained

All of the experiments just related show that at least as far as culture experiments go, not only is the iodine catgut absolutely sterile, but also that it is absolutely impossible to infect it either with cultures of known activity or with resistant spores, or with ordinary pus



Advisedly and with caution have I used in my *résumé* the expression that these results are true as far as the culture experiments are concerned, as I expected that the objection would be raised that in an operation we would have to deal with conditions which materially differ from any laboratory experiment. This was brought to my attention by Dr Lilienthal, of Mount Sinai Hospital, who conceded that the catgut was sterile, and also that it was uninfecible, provided sufficient time was given for the iodine to exert its antiseptic action. He argued that in the course of an operation infections of the catgut might occur, which catgut being used immediately thereafter, before the iodine had sufficient time to exert its bactericidal action, might possibly cause an infection in this manner. Dr Lilienthal was of the opinion that a nearer approach to the actual use of the catgut could be obtained in the following manner. That catgut infected with various germs is inoculated into a nutritive medium, but is removed therefrom in a few seconds. While conceding the validity of the argument, I would not concede the validity of the experiment, but, *experimenti causa*, I have carried out the tests suggested, using both iodine and von Bergmann catgut, the result of which in brief is the following:

EXPERIMENT 133—January 19. Immersion for a few seconds of iodine gut infected with *Bacillus coli* into bouillon was followed by no growth.

EXPERIMENT 134—January 19. Immersion for a few seconds of von Bergmann catgut infected with *Bacillus coli* into bouillon was followed by a growth.

EXPERIMENT 135—January 19. Immersion for a few seconds of iodine gut infected with *Staphylococcus aureus* into bouillon was followed by no growth.

EXPERIMENT 136—January 19. Immersion for a few seconds of von Bergmann catgut infected with *staphylococcus aureus* into bouillon was followed by no growth.

EXPERIMENT 137—January 19. Immersion for a few seconds of iodine gut infected with *Bacillus anthracis* into bouillon was followed by no growth.

EXPERIMENT 138—January 19. Immersion for a few seconds of von Bergmann catgut infected with *Bacillus anthracis* into bouillon was followed by no growth.

EXPERIMENT 139—January 19 Immersion for a few seconds of iodine gut infected with *Bacillus subtilis* into bouillon was followed by no growth

EXPERIMENT 140—January 19 Immersion for a few seconds of von Bergmann catgut infected with *Bacillus subtilis* into bouillon was followed by a growth

While, as already stated, I do not concede the validity of the argument that the experiments just related are a closer approach to infections as they might occur accidentally in the course of an operation, they are of interest in so far that they also tend to prove that it is impossible to get infections with the iodine catgut in this manner, all the experiments with iodine catgut gave a negative result, while on the other hand two out of the five experiments with the von Bergmann gut (the coli and subtilis experiment) gave a positive result

In order to determine the possibility of such infections, experiments would have to be done actually upon the human body, but, as this would be entirely too risky and dangerous, no one will reproach me with the incompleteness of my studies I have attempted to approach this form of infection with animal experiments, and following is the result

EXPERIMENT 148—January 27 On January 26 I made a bouillon culture of an actively growing, virulent *Bacillus anthracis*, and permitted it to grow for twenty-four hours in the thermostat On January 27 I made a small incision upon the back of a guinea-pig, and bluntly made therein a subcutaneous channel, into this I buried two pieces of iodine catgut about two inches in length, which had been dipped into the anthrax culture, and closed the opening with a suture January 28 The animal looked and acted perfectly well, and, in spite of this extremely severe test, I had strong hopes that the animal might overcome the infection In this I was disappointed, as on the following morning, January 29, the animal was found dead

EXPERIMENT 147—January 27 In this experiment I repeated in all details Experiment 148, with the exception that I used von Bergmann catgut On January 28 the animal looked and acted sick and refused its nourishment On the following morning, January 29, the animal was found dead

It is seen, therefore, that both these experiments (148 and 147) gave a negative result, inasmuch that both animals died Nor could I expect anything different, and I so ex-

pressed myself at the time I operated upon the animals I know that sufficient of the culture adhered to the dripping wet catgut to kill any animal, and I also know that in the introduction of the catgut sufficient of the culture medium was wiped upon the wound at some distance from the iodine catgut to cause an infection and death. The only conclusion to be reached, therefore, is that both animals died in consequence of a surcharge of the infective medium, and I am sure every one will agree with me that this is not the way catgut infections occur in the course of an operation, even if we would concede the possibility of anthrax infection.

It was necessary, therefore, to find a method which would more nearly approach the conditions as they might occur in practice. I believe I have found it by proceeding in the following manner:

EXPERIMENT 170—February 4. Two pieces of iodine gut, about two inches in length, were thoroughly moistened in a twenty-four-hour bouillon culture of virulent anthrax, they were then dried between folds of sterile blotting-paper, and immediately buried in a channel beneath the skin of the back of a guinea-pig. February 5, the animal looks and acts perfectly well. February 6, apparently no change in the condition and behavior of the animal. February 7, the animal was found dead in its cage.

EXPERIMENT 171—February 4. Repetition of Experiment 170, with the difference that in place of iodine catgut von Bergmann catgut was used. February 5, the animal was found dead in its cage.

It is seen that the last two experiments (170 and 171) were followed by the same result as the more severe experiments (147 and 148)—both animals, the one with infected iodine gut as well as the one with infected von Bergmann catgut, died. It is true that the former outlived the latter by forty-eight hours, but that is, and should be, no criterion. What we are looking for are positive results in the form of complete immunity, and not merely prolongation of life, at best, we are entitled perhaps merely to deduct so much from these experiments that the iodine catgut was sufficiently strong to neutralize some of the anthrax bacilli, but there still remained sufficient to eventually kill the guinea-pig. Even this,

however, would be some encouragement from the surgeon's point of view, as it must be recollected that, as a general rule, we are not working with catgut which has been soaked, like in the experiments related, in virulent anthrax cultures

All in all, I do not see how we could imitate the conditions exactly to fulfil the objections raised by Dr Lilienthal. It is true that I could perhaps repeat the experiments with bacteria, which are less fatal than anthrax, for instance, with the ordinary pus-forming germs, but I do not see that much would be gained by it. For instance, the presence of pus would by no means be proof of the inefficiency of the iodine catgut, as it might be argued that the purulent infection was introduced otherwise and not with the catgut. I confess, therefore, that for the want of a good method, I am for the present unable to refute Dr Lilienthal's argument.

The result of the various experiments carried out to prove the sterility of the catgut are to my mind so convincing that a general *résumé* is hardly indicated.

2 TENSILE STRENGTH — Having proven the aseptic and antiseptic properties of iodine catgut, it remained for me to show that its tensile strength was not inferior, and perhaps superior, to other forms of catgut.

It is not sufficient to state that in actual use we have found that the catgut was sufficiently strong for all the requirements, or all the demands made upon it, nor can much value be put upon the statements of others that the catgut was too weak, and that it has lost a considerable part of its tensile strength. A great deal depends upon the personal equation of the individual who is using or testing it. If "A" wishes to prove that any catgut is strong, he does not pull quite as hard as "B," who wishes to prove that the catgut is weak, and *vice versa*. The only way to either prove or disprove anything of this nature is by actually and accurately measuring the amount of pulling force applied. This would be comparatively easy with most substances, but with catgut it is surrounded by almost insurmountable difficulties. This is due to many facts about

catgut, all of which have a most important bearing upon its tensile strength. First, there exist no accurate standard sizes of catgut. It is true that we can buy in the market so-called standard sizes, which are variously labelled from 00 upward, but in reality this does not mean anything, as anybody can readily convince himself by simply glancing at a number of rolls. I have, for instance, frequently examined packages of catgut marked for a certain size, and found all possible variations, both above and below the size stated, in some of the larger sizes measured (No. 2) with an accurate micrometer the variations were as much as fifteen one-hundredths of a millimetre in diameter. Fifteen one-hundredths of a millimetre may appear a triviality, but in reality it makes a very great difference, as the strength of a given piece of material varies not as does the diameter, but as does the square of the diameter. Second, there is an important variation in size, not only between different rolls, but also in different parts of the same roll, and we find thinner portions alternating with thicker portions, and it is perhaps needless to add that a given piece of the catgut is only as strong as its weakest portion. Third, that the strength of the catgut depends not only on its diameter, but also upon other undetermined qualities, which vary not only in different rolls, but also in different portions of the same roll, *e g*, light portions alternate with dark portions, translucent with almost transparent portions, alternate with opaque portions. Finally, that the strength of the catgut depends upon the workmanship originally used in its preparation, I mean how tightly it was originally twisted to get a diameter of a certain size. It is self-evident that of two pieces of catgut of equal diameter that one will be stronger which is twisted tighter, because in reality there is much more catgut substance in it. I have paid a good deal of attention to this point, and finally, by a mere glance, I could tell beforehand which catgut would be strong and which weak. All in all, it is seen that this was by no means an easy question to solve.

But after making due allowance for these qualities inherent to the catgut, there arose a further difficulty, inasmuch

as I was not in possession of any apparatus by which I could accurately determine its tensile strength. The crude affairs that I was able to rig up were not sufficiently accurate, and

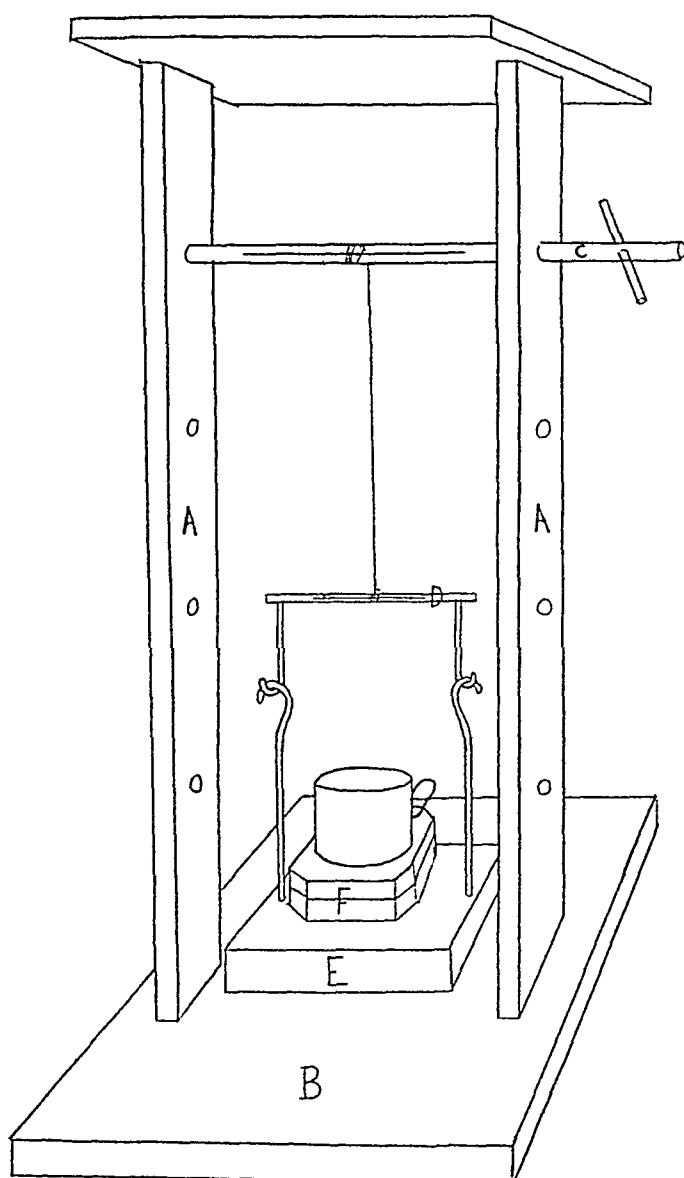


FIG 1—Apparatus to test tensile strength of catgut

were so cumbersome that I could not make sufficient headway. In this dilemma I consulted Professor Hallock, of the Department of Physics, at Columbia University, as no apparatus was

on hand to determine the tensile strength of catgut, Dr Forbes, of the Department of Physics, of Columbia University, very kindly designed and constructed the following apparatus for me (Fig 1)

The instrument consists of two parallel vertical bars (A, A) firmly fixed in a stand (B) and connected above. The sides of A and A are perforated at different heights, and through any pair of these holes a cross-bar (C) made of brass may be firmly fixed, the latter is perforated by a long slit and fine openings through which the catgut may easily be threaded, by a few rotations of C the catgut will be held solidly, and yet will hang only in a tangent from the round surface of C, so as not to be cut by any sharp edge. The other end of the catgut is then fixed in a similar manner to another brass bar (D) which supports a suspended platform (E). This platform in turn supports any number of weights (F) which may be placed upon it. On top of the weights there rests a small cup into which shot may be poured. When the amount of shot poured in is sufficient to break the catgut, it is weighed and the amount added to the original weights first placed upon the platform, plus the weight of the other suspended parts of the apparatus, which, of course, have previously been determined.

While this apparatus is by no means perfect, we believe it to be more devoid of gross errors than apparatus which work with a spring-balance, as it enables us to get nearer to the actual breaking strength of an individual piece of catgut. Soon after the construction of the apparatus, however, I found that a great deal depended on the intrinsic characteristics of the catgut and that it would not do to merely measure a single piece of the catgut of a given size, and from it to draw the conclusion that this size of catgut has a given breaking-point. The figures vary so much, that the only way to determine this was to determine the breaking-point of many rolls, and from different parts of the same roll, and then to draw the final deduction from the grand average.

Following is the result of my measurements

NUMBER 0 CATGUT		
Iodine Catgut Grammes	Von Bergmann Catgut Grammes	Raw Catgut Grammes
2827	3595	2801
3778	3691	3226
2616	2731	3216
4241	3136	
3791	3013	
3576	2912	
3696	3078	
4182	3126	
4017	2987	
3928	3175	
<hr/>	<hr/>	<hr/>
Av'age, 3665	3180	3081

NUMBER 1 CATGUT		
Iodine Catgut Grammes	Von Bergmann Catgut Grammes	Raw Catgut Grammes
4723	4681	4561
4067	3866	4866
4916	4421	5456
6186	4567	
5796	4658	
4911	4649	
5941	5018	
6076	4925	
5866	4532	
5978	4612	
<hr/>	<hr/>	<hr/>
Av'age 5446	4592	4961

NUMBER 2 CATGUT		
Iodine Catgut Grammes	Von Bergmann Catgut Grammes	Raw Catgut Grammes
7150	7291	6896
7251	7520	6686
6526	7440	6496
7080	6975	
8716	6942	
6826	7257	
7043	7261	
7251	7223	
7120	6711	
8239	6709	
<hr/>	<hr/>	<hr/>
Av'age, 7320	7132	6526



While this gives us an excellent and very fair idea of the tensile strength of the catgut as it is used for suture material, it is by no means the tensile strength of the catgut as it is used for ligatures, particularly for tying heavy pedicles, because in the latter we have to deal, in addition, with the knot problem, which was found to be a most important element in the tensile strength of catgut. It was necessary, therefore, to repeat all of these experiments with the addition of a knot in the catgut measured, for the sake of simplicity only a single knot was tied, no doubt a surgeon's knot would give still greater differences.

Following was the result of these measurements

#### NUMBER O CATGUT

Iodine Catgut Grammes	Von Bergmann Catgut Grammes	Raw Catgut Grammes
2146	Less than 1000 *	2076
2151	Less than 1000 *	2021
2166	Less than 1000 *	1856
2351	2346	
2306	2161	
2243	2246	
2116	2361	
2296	2111	
—	—	—
Av'age, 2220	2244	1984

#### NUMBER I CATGUT

Iodine Catgut Grammes	Von Bergmann Catgut Grammes	Raw Catgut Grammes
2821	3068	3230
2786	3148	2871
2655	4106	2886
3783	2900	
3113	3801	
3491	3946	
4321	2995	
4196	3161	
4229	4120	
4176	3221	
—	—	—
Av'age, 3557	3446	2996

\* Not figured in the average

NUMBER 2 CATGUT

Iodine Catgut Grammes	Von Bergmann Catgut Grammes	Raw Catgut Grammes
4431	5636	3961
4885	5541	3513
4011	5840	3928
4138	4005	
4126	5311	
4081	5124	
4951	5146	
4306	5634	
5356	5214	
5606	5139	
5066	5071	
5184	4923	
<hr/>	<hr/>	<hr/>
Av'age, 4678	5217	3800

The tests with the unknotted catgut, in spite of the great variability in strength, show that the raw catgut is by far the weakest of the three, and that the iodine gut is by far the strongest, this is particularly the case with the smaller sizes, the size most frequently used both as suture and ligature material

If we now turn our attention to the knotted catgut, we again find that the raw catgut is by far the weakest, Numbers 0 and 1 have practically the same tensile strength if prepared with iodine as with the von Bergmann method, though even here there is some advantage in favor of the iodine catgut, but with the Number 2 catgut there is evidently some advantage in favor of the von Bergmann catgut I believe, however, that this is merely accidental, as in some spools the iodine catgut gave just as high values as the best of the von Bergmann catgut It is not impossible that more extensive measurements will equalize these values

All in all, I am perfectly satisfied that the iodine catgut has not only not lost any of its tensile strength, but apparently it has materially gained

3 METHOD OF PREPARATION —Under this heading I can only repeat what I have already stated in my article previously referred to, viz , “ The preparation of this catgut is simplicity

itself" But, for the sake of completeness and because of a slight modification in its preservation, it may perhaps not be amiss if I again go into detail regarding this point The catgut, just as it is bought from the dealers, *i e*, without removing the fat, is loosely wound, preferably in a single layer, on to the spool, and tied at both ends in order to prevent unravelling It is then immersed for eight days in a solution of iodine, one part, iodide of potassium, one part, distilled water, one hundred parts (The solution is prepared by dissolving the iodide of potassium in a small quantity of the water, to which the iodine, previously finely pulverized, is added, and the whole diluted up to one hundred parts )

According to Claudius's directions, the catgut was preserved in the original solution without any change, but as already stated, having found that after long-continued immersion in the solution the catgut loses some of its tensile strength, it was necessary to obviate or circumvent this drawback This was done in a very simple manner, inasmuch as all that was necessary was to remove the catgut from the solution at the end of the eight days, and to preserve it thereafter merely dry in a sterile vessel, preferably in one not exposed to the light (If necessary, the drying process might be hastened by placing to one side of the vessel in which the catgut is kept a small vial containing a little sulphuric acid ) In short, formerly we used a catgut which was wet, and by the newer method we use it dry

It is used dry just as it is cut from the spool, without any previous immersion in carbolic solution or sterile water Any unused catgut may be resterilized on a future occasion

That this method of preparation is simple no one can deny, that it is extremely cheap, itself no mean item, particularly in large hospitals, where quantities are used, is also self-evident, one gallon of the solution, requiring 608 grains of iodine and an equal amount of iodide of potassium, costing only forty-two cents

It is important to keep the solution in well-stoppered bottles or jars because the iodine is volatile, as can be seen by

the purple color of the atmosphere on top of the solution, and in time it deteriorates. Solutions good enough to use should in bulk have a deep brown, almost black color, any solution not corresponding to these physical requirements should be discarded.

The new method of preservation has produced also a change in the physical properties of the catgut, and, I regret to say, in some respects this change is a slight disadvantage, but even then it is better than catgut which is used out of alcohol. At present it is of a deep brown, almost black color, and still retains the characteristic odor of iodine, it is perfectly smooth, not swollen, as one might expect from its immersion in an aqueous solution. The old Claudius catgut was exceedingly convenient to use, as it did not kink, nor curl up like catgut used from alcohol, but this newer catgut is somewhat stiff, like a fine wire, but it has no tendency to kink up, and particularly when it is used as a suture it soon becomes soft and straight. All in all, a long-continued use of it has proven to me its superiority also in this direction over alcohol catgut.

4 ABSORPTION.—Regarding this point, we have not made any recent observations. From a practical stand-point, I may say that the knots stay tight and do not tend to untie or loosen, and we have never seen any untoward symptoms which could be traced to a too early or too late absorption.

In this connection it might be of interest to mention that Dr. Bookman has attempted to gain experimentally some idea regarding its absorption, and he found that the von Bergmann catgut was completely digested in twenty-four hours in artificial gastric juice (pepsin and HCl), while on the other hand the same amount of iodine catgut was only partially disintegrated in seventy-two hours. From this we would be entitled to conclude that the iodine catgut is more resistant to absorption than the von Bergmann catgut, were it not for the fact that conditions in the body are different from the test-tube, in the latter we have a definite quantity of digesting fluid but in the former we have leucocytes and constantly changing currents, which no doubt materially aid in absorp-

tion In general, we may say that there is no material difference regarding the time of absorption between this and catgut prepared by other methods

DISADVANTAGES —Of these I know none, but, in order to prevent any misconception, it will perhaps be wise if I briefly mention those possibilities which might be raised against it

The toxic effect of the iodine might cause some anxiety in the minds of some surgeons There need be no fear on this account, because, first, even in the most extensive operation, *e g*, radical operation for carcinoma of the breast, the toxic dose can never be reached, second, because the iodine is divided so minutely that it quickly enters into a chemical combination with the salts of the body fluids, and forms only innocuous iodine compounds, etc, and third, because of late, after being so astonished at the almost marvellous antiseptic properties of the iodine solution, I have in a large number of cases used iodine solution for dressing wounds, using at each dressing large quantities of gauze dipped into iodine solution, but in no instance did I find even the slightest trace of irritation (I may state here that I am now at work experimenting extensively with iodine gauze as a dressing, and thus far my experiments are so encouraging that I intend to publish the results at some future date) For the reasons stated, I may also reply to the objections of those who fear that the iodine may act as an irritant upon the tissues

The odor of the catgut and the staining of the linens are so trivial that they do not even merit discussion, particularly is this true of the latter, as by experience we have found that the stains are not permanent and readily disappear in the laundrying process

I believe that our clinical experience and the experimental work as related in this paper fully justify the following conclusions

- 1 The "dry" iodine catgut is absolutely sterile
- 2 It is impossible to infect it by ordinary means
- 3 Its imbibition with iodine is not sufficient to act as an irritant upon the tissues

4 Its tensile strength is superior to raw catgut and to that prepared by the sublimate-alcohol method

5 It is easily and cheaply prepared

6 It is absorbed only after it has served the purposes for which it was intended

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# DENTIGEROUS CYST OF THE LOWER JAW<sup>1</sup>

SITUATED AT THE SYMPHYSIS MENTI

BY GEORGE BARRIE, M D,

OF WASHINGTON, D C

THE patient, a man, twenty-one years of age, at the age of sixteen years first noticed a lump, the size of a small marble, below the lower left canine tooth, which slowly and gradually increased in size until a year ago, since which time it has rapidly enlarged, without, however, causing any pain or real discomfort. During this period the canine tooth had gradually become displaced, and lay horizontally on the enlarged alveolar border. Four years ago patient had the second molar, on lower jaw, of left side removed, on account of toothache. He had no trismus, or difficulty in mastication, previous to seeing the dentist. Speech has been rather thickened during the past year. There is no specific history.

When first seen by the reporter, he was anæmic and presented a rather uniform swelling of the lower jaw, extending from the anterior border of the masseter muscle on the right side to the angle of the jaw on the left.

There was no solution of continuity of skin over this area, or evidence of acute inflammation. The skin was smooth, somewhat tense, and movable.

The lower lip was swollen and pushed outward, the tongue protruded between the lips. He constantly dribbled saliva. He was unable to open his mouth beyond a space of 3 centimetres, and stated that he could not then masticate any food, and was living upon liquids.

On separating the lips, it was evident that the lower left canine tooth was missing, occupying its site was a circular opening, 1 centimetre in diameter. The remaining teeth of the mandible were apparently normal. There was considerable gingivitis along the whole alveolar border.

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<sup>1</sup> Read before the Medical Society, District of Columbia, May 17, 1905.

On the posterior aspect of the symphysis was felt a firm, resistant, bulging mass, destroying the normal contour of the bone, and extending in a direct line from molar to molar on either side. The anterior surface was compressible. The glands in the neck were not enlarged.

On insertion of a probe through the opening, left by the extracted lower left canine tooth, a cavity extending 4 centimetres to the right of the opening and 4 to 5 centimetres on the left could be mapped out. On the left side several smaller pockets or cavities were detected with the probe. Upon pressing the point of the probe, which was within the cavity, anteriorly towards the skin it met with no bony or shell-like resistance, and at any portion within the area of the cavity anteriorly the probe point could be distinctly outlined, demonstrating, anteriorly, destruction of the bone and periosteum.

At the extreme left lateral portion of the cavity denuded bone was felt. The anteroposterior width of the space was apparently about 3 centimetres.

Cultures were made from different parts of the cavity, but it was later found that infection from the mouth flora was too great to permit of any deductions being made therefrom.

Temperature in axilla, normal.

October 28, 1904, a mesial incision was made from the mucocutaneous border of the lip to the hyoid bone. The separation of the tissues disclosed an ugly looking necrotic cavity. The periosteum and bone substance on the anterior aspect of the mandible, above, from the alveolar margin to the protuberentia mentalis below, and laterally so far as the tissues of the wound could be extended on either side, showed complete destruction of periosteum and bone. Sufficient room not being obtainable by the mesial incision, the lip was cut through, and lateral incisions were made below the chin, to the anterior borders of the masseter muscles on either side, from the median incision, and the flaps reflected.

On the inner surface of the muscle of the reflected flaps were seen patches of necrotic periosteum adherent to infiltrated muscle tissue, these were carefully clipped away.

The mylohyoideus, geniohyoideus, and genioglossus muscles, with the periosteum, were then detached posteriorly, mucous membrane incised anteroposteriorly the necessary teeth ex-



tracted, the jaw sawn through at the second molar on the right, and at the last molar tooth on the left side. The mucous membrane was brought together by running suture, thus closing the wound within the mouth. The detached mylohyoid muscles were brought forward to the chin wound and sutured. There was practically no loss of blood during the operation. The anæsthetic was taken very badly.

Impressions were made by a dentist of the teeth remaining on the stumps on either side of the jaw,—two on the right and one on the left. From the impressions he made gold crowns, which were snugly fitted over the teeth, soldered to these crowns were two heavy strands of platinum wire bent to the shape of the mouth. Before application, this prosthetic measured from crown to crown 1 centimetre more than the space between the teeth, that is to say, a line drawn from the molar on the right, across the tongue to the molar on the left, was about 1 centimetre shorter than the prosthetic appliance. This acted beautifully as a splint and spring, gave no discomfort to the patient, and prevented any contraction towards the middle line by the stumps. It also prevented falling in of the lower lip and allowed perfect cleansing of the mouth and mucous membrane line.

At the end of four weeks the wire frame was encased in a hard rubber plate, which the patient is still wearing. This plate is grooved below in its whole length. An upgrowth of tissue is now taking place within the grooved space, which will give a firmer base for the plate, and later it is the intention to make a new plate, with teeth attached, for cosmetic and serviceable purposes. At present the patient gets along very well with the appliance as it is. He has no difficulty in removing and replacing the plate at will, so that it can be thoroughly cleansed (Figs 1 and 2)

In operations of this character on the jaw, where a complete solution of continuity has been made, the difficulty has always presented itself as to the best method to overcome the inevitable contraction inward of the stumps, Lallemand<sup>1</sup> reports a case in which a space only 2 centimetres remained between the stumps after cicatrization of the attached muscles

Martin,<sup>2</sup> of Lyons, Fritzsche,<sup>3</sup> Nux,<sup>4</sup> Stoppany,<sup>5</sup>



FIG 1—Showing result of removal of dentigerous cyst of mandible, prosthetic appliance held in hand



FIG 2 —Showing result of removal of dentigerous cyst of mandible, profile view

Partsch,<sup>6</sup> Sachse B,<sup>7</sup> Bonneken,<sup>8</sup> and others have devised various so-called artificial jaws for overcoming defects left by displaced bone. The plan adopted in this case is simpler than any of the methods I have so far been able to find recorded, and is, in fact, the only case I know of where the prosthetic has been made and applied in this way. Its use is naturally limited. In a case where no teeth remain to which to attach crowns, it would of course be useless, but where indicated, it avoids the use of bolts, nuts, nails, etc., boring holes in the stumps, and leaving channels for mouth infection.

A bandage supporting the chin was kept on the patient during his stay in the hospital. He left the institution well two weeks after the operation.

I am indebted to Dr J C Bloodgood, of Johns Hopkins, for a pathological report of the specimen, which is as follows:

*Gross Pathological Diagnosis, Dentigerous Cyst of Lower Jaw*—There is a bone capsule present everywhere except anteriorly. Here the bone is absent, and there is an irregular opening about 3 by 4 centimetres.

The bone is very thin. In the single cavity there are bony partitions. There is an opening on the alveolar border corresponding to the extracted canine tooth.

In the cavity I can make out a definite connective-tissue lining which can be separated, leaving normal bone behind. There is in addition, on top of this membrane, a hæmorrhagic granular friable tissue that does not look like adamantine epithelioma, but somewhat like giant-cell sarcoma, or a partly organized bloody exudate.

*Microscopic Study*—In a section of the cyst wall, 1 millimetre thickness, stripped from bone capsule, the wall towards the bone is composed of a myomatous connective tissue containing numerous blood-vessels. The surface of the wall is lined by a pretty thick layer of epithelial cells of the adamantine type. The basal cell has a spindle nucleus perpendicular to the basement membrane.

In the next layer the spindle cell in some places is perpendicular, in others parallel. The nucleus is still spindle. More superficially the cell assumes the typical stellate adamantine form. The nucleus of the cell in the superficial layer is round, the cell larger, and hardly takes the stain. Such is the degeneration seen in the adamantine epithelium beneath this epithelial lining, in places there is slight lymphoid cell infiltration and some polynuclear leucocytes.

In a section of the granular tissue within the cyst wall, the histology is about similar to that of the section already described. It is lined by the same adamantine epithelium, which is broken and de-

stroyed in places, the connective tissue is more vascular. There are large areas of hæmorrhage and organized blood-clot. There are no giant cells, no evidence of tuberculosis. The adamantine epithelial lining shows no atypical downgrowth.

*Diagnosis*—Jaw, benign dentigerous cyst, lined by adamantine epithelium. The first case observed.

*Note*—This is the first simple dentigerous cyst that I have observed to be distinctly lined by a layer of adamantine epithelium.

The histological picture above described, showing a distinct layer of adamantine epithelium on a dentigerous cyst membrane, would seem to add further to the proof of the conclusions of Malessez and Witzel, that the dentigerous cyst, cystadenoma, and adamantine epithelioma of the lower jaw all have one etiological factor to start from, namely, the so-called "débris épithéliaux paradentaire" of Malessez. It has also been shown that this débris remains in the bone substance of the lower jaw during adult life.

This case differs from the so-called adamantine epitheliomata and cystadenomata in showing no invasive or irregular appearance in its epithelial structure.

Here we have a distinct layer of adamantine epithelium without downgrowth or apparent malignant change. Probably only temporary.

Steensland,<sup>9</sup> in his latest contribution to the subject, acquiesces in the conclusions of Malessez<sup>10</sup> as to etiology of the adamantine epitheliomata of the jaw. And Pincus,<sup>11</sup> in his article on "Centrale Kystadenone Keifer," states that all authors are agreed as to the conclusions of Malessez and Witzel<sup>12</sup> regarding the causation of these tumors. Cumston<sup>13</sup> also agrees in these views, giving Magitôt<sup>14</sup> credit for his earlier theories along these lines.

After a careful review of all the literature on the subject of tumors of the jaw, which is very extensive, I am unable to find a single case of so-called dentigerous cyst occupying the site of the tumor here presented. In every case so far recorded the tumor has been unilateral, in this case it will be observed that it was central, causing destruction of the symphysis, and extending to the molars on either side of the jaw.

It is also the only case of so-called simple dentigerous

cyst so far described in the literature of the subject that exhibits an epithelial lining on a dentigerous cyst membrane

In only one instance do I find a somewhat analogous case, which is reported by Becker In Becker's <sup>15</sup> case the tumor was median, it was a single cyst with wall from 1 to 2 millimetres in thickness and lined throughout with adamantine epithelium

Pincus and Steensland group Becker's case among their reported cases of adamantine epithelioma, cystic, semicystic, and solid, of the jaw, which they collected from the literature of the subject

In only four instances can I find it stated in the reported cases of cystadenoma and adamantine epithelioma of the jaw that the site is medium

In the cases reported by Bloodgood,<sup>16</sup> of dentigerous cyst, adamantine epithelioma, and adamantine epithelioma in a dentigerous cyst of the lower jaw, the cases have all been unilateral as to location

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# A CONTRIBUTION TO THE KNOWLEDGE OF EN- DOTHELIOMA AND PERITHELIOMA OF BONE

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INTRODUCTION —From time to time there have been reported cases of bone tumor showing certain peculiarities of structure which have served to separate them from the ordinary osteo- and periosteal sarcomata on the one hand, and the peculiar tumors or group of tumors classified as myeloma on the other. Such cases were reported in the sixties by Lucke, Kocher, and Billroth, in the seventies by Engelmann, Jaffé, Sudhoff, and others. To Hildebrandt (1891) belongs the credit of collecting these cases from the literature and giving a clear clinical and pathological picture of this affection. His work was based on eight cases, including one of his own. Volkmann (1895), in his exhaustive article on endothelial tumors in general, reported a case of endothelioma of bone, abstracted the previously reported cases, and analyzed the tumors according to their seat and histological structure. Volkmann's conclusions were based upon fourteen cases, one of which (Zahn's second) was evidently a myeloma and should be excluded. Including our own four cases, herewith reported, there are now twenty-three cases available for analysis and generalization. The present work consists in (1) An abstract of the previously

reported cases (2) Report of four new cases (3) Pathology of endothelioma and perithelioma of bone, (a) general pathology, (b) histology, (c) histogenesis (4) Etiology (5) Clinical history, diagnosis, and treatment

The following cases classed as endothelioma or perithelioma primary in bone are to be found in the literature The earlier ones have been already collected in the articles of Hildebrandt, L Volkmann, and Gaymard, but they have not appeared in English

CASE 1—LUCKE, 1866, reported the case of a woman forty years of age, who complained of lancinating pains and a swelling in the right arm, and on reaching to a high place developed a spontaneous fracture An elastic tumor rapidly developed The axillary glands were not invaded Disarticulation at the shoulder, no recurrence after three and one-half years

*Tumor*—The tumor was covered with healthy skin and atrophied muscle On section it was soft, of a red color, and contained a large cavity filled with bloody fluid Microscopically there was a fine reticulum with blood-vessels, supporting bands, and gland-like columns of epithelial-like cells, many of which contained colloid material

Origin in the marrow cavity

CASE 2—KOCHER, 1868, a male, aged sixty-six years, eight months after an injury developed a pulsating tumor, with a systolic bruit, of the frontal and temporal bones

Under the impression that it was an aneurism the carotid was ligated Pulsation disappeared but returned, when the growth was extirpated

The tumor developed between the pericranium and the dura Microscopically the tumor was very vascular and contained spaces lined with rows of cells and containing blood in their lumina Marked hyaline degeneration No metastases

CASE 3—BILLROTH, 1869 A male of middle age, with a pulsating tumor of the lower half of one tibia Amputation On section, the canal of the lower part of the tibia was filled by the tumor Microscopically, the growth was very rich in thin-walled blood-vessels, and was composed of epithelial cells Origin The blood-vessels of the bone marrow, probably perithelioma

CASE 4—ENGELMANN, 1871 A male, forty-eight years old, developed a tumor of the sternum and ribs the size of a man's head Multiple metastases of lungs and lymph-glands The tumor was firm, encapsulated, and had cysts containing colloid material

Microscopically, the tumor was composed of round and elongated alveoli and gland-like columns of cells, with colloid degeneration En-



gelmann regarded the marrow cells as the origin of the tumors, probably endothelium of lymphatics

CASE 5—JAFFÉ, 1874 Male, aged twenty-four years A pulsating tumor of the left iliac bone developed to the size of a pear in six months Partial extirpation, death

The left iliac bone was extensively invaded by a tumor mass with an alveolar structure and many small cavities Near the centre these were the size of a pea and red in color

At autopsy, numerous metastases were found in the lungs and pleuræ. On microscopical examination, the tumor was very vascular and showed an alveolar structure, some of the spaces resembling acini There were spaces lined with several rows of cylindrical cells and containing no blood-corpuscles

*Origin*—Jaffe thought the inner layer of the periosteum

CASE 6—SUDHOFF, 1875 Female, aged thirty-two years, complained of pain in the joints for three years There was a tumor of certain of the spinal vertebræ and of the sacrum Death from pressure-mylitis At autopsy the seventh dorsal vertebra was swollen, the bodies of the twelfth dorsal and first lumbar vertebræ were softened and invaded with a grayish white marrow-like substance From the tenth to the twelfth dorsal vertebræ a tumor mass compressed the spinal cord The second, third, fourth sacral vertebræ, the sternum and left femur were also involved The femur was the seat of a spontaneous fracture

In structure the tumors were in some places composed of large cells, round or polygonal in shape, with single nuclei and arranged in large alveoli supported by a stroma of fibrous and elastic tissue In other places the arrangement was tubular, with cylindrical or flat cells and containing a fine lumen

The origin of the growth was thought to be from the vascular endothelium

CASE 7—SCHWEININGER, 1876 A large centrally situated "adenoid" sarcoma of the humerus (sex and age not given) Microscopically the growth showed a plexiform arrangement and gland-like tubules The origin was thought to be from the endothelial cells of the blood and lymph vessels and lymph spaces

CASE 8—V LUKOVICZ Male, aged sixty years For twenty-one months before coming under observation sciatic pain on the right side When first seen he had a diffuse thickening of the upper part of the right femur In a short time there developed a rapidly growing tumor of the upper third of the femur, with spontaneous fracture of the latter Death occurred eight months after the first occurrence of the sciatic pain

At autopsy there was found a large mucoid tumor which involved two-thirds of the shaft of the right femur On section the growth had a spongy appearance and contained a number of cysts containing mucoid material There was extension to the pelvis and metastases in the pleuræ

Microscopically the tumor consisted of large and small cyst cavities lined with low cubical or cylindrical cells of the epithelial type. The

cavities contained mucus, as did some of the cells. The tumor apparently took its origin from the endothelial cells of the connective-tissue lymph spaces.

CASE 9—KOLACZEK, 1880. Male, aged eighteen years. A large tumor of the upper part of the left tibia which had developed in five and a half months. The leg was very much enlarged, slight enlargement of the inguinal glands.

*Amputation*—The greatest length of the tumor was 22 centimetres and the greatest width 30 centimetres. It consisted of a hard and soft part, the latter containing cysts. The firm portion showed the histological structure of a spindle-cell sarcoma, while the soft portion showed endothelial lined spaces containing no blood-corpuscles.

*Origin*—Probably from lymph spaces and vessels.

CASE 10—ZAHN, 1889. Female, fifty-three years old, had a tumor of the base of the skull with numerous metastases (vertebræ, ribs, and liver). Microscopically the tumor showed an alveolar structure with bands and tubules of epithelial-like cells, some of which showed colloid degeneration.

The tumor was thought to have its origin in the endothelium of the blood capillaries. A second case reported by Zahn (*Beitrage zur Geschwulstlehre, Deutsche Zeitschrift fur Chirurgie*, 1885, No. 22), reported as a multiple myeloma, is included in Volkmann's list, but I think that, with the similar tumor of Rustilzky, it should be excluded.

CASE 11—HILDEBRANDT, 1891. Male, forty-five years of age. In childhood he sustained a fracture involving the right elbow. Nine months before coming under observation he had pain in the right arm, six months before being seen there was swelling of the right arm, and fourteen days before there was a spontaneous fracture. Amputation at the elbow, no recurrence on discharge one month later.

The tumor, which involved the lower end of the arm, was nodular in places, but the joint was intact. There was a fracture of the bone at the seat of the tumor. The latter was the size of a child's head, soft, and on section was red in color, and contained a central cavity, the size of an apple, filled with reddish gray material. The tumor was very vascular. It extended to the periosteum.

Histologically the growth consisted of blood-vessels, usually capillaries, from the sides of which there were cylindrical cells arranged in regular rows, forming tubules. The vessels contained red blood-cells.

*Origin*—Stated as the perithelial cells of blood-vessels.

CASE 12—DRIESSEN, 1893. A male, aged seventy-four years, had pain in the left elbow for two or three years. On admission there was a small tumor of the upper end of the left ulna. The tumor was removed, and there was no recurrence fourteen months later. The tumor was egg-shaped and measured 6 by 4 centimetres, and was firm in consistency. In places it was white, and in others of a dark-brown color.

Histologically the tumor showed both alveolar and tubular arrangements. The cells lining the spaces were epithelial-like, cylindrical, oval, and polygonal in shape. The growth was well supplied with blood-

vessels and fibrous tissue The tumor cells contained fat and glycogen Driessen thought the tumor had its origin in the endothelium of the lymph spaces of the bone marrow There was no apparent connection with the blood-vessels

CASE 13—SPIEGELBERG, 1894 Female, aged sixty-two years No history was obtained At autopsy there was widespread tumor formation in various bones, the tumors varied from a walnut to a fist in size They evidently had their origin in the bone marrow Especially large growths sprang from the right os ilii and from the right metatarsal bone The ribs and sternum were extensively involved A small metastasis was found in the spleen, the other organs were free from tumors

Histologically the tumors showed a well developed fibrous tissue stroma marked in places by the presence of spindle-shaped cells In this stroma there were large and small alveoli containing cells of the size of ordinary pavement epithelial cells with round, deeply staining nuclei The cytoplasm stained well with eosin The cells varied markedly in shape and size, some were the size of ganglion cells The cells were arranged in rows and cylinders, and between some rows a definite lumen could be made out Spiegelberg regarded the growth as an endothelioma developed probably from the lymph spaces Spiegelberg alludes briefly to a second and apparently similar case, without giving, however, either clinical or anatomical details

CASE 14—VOLKMANN, 1895 Female, aged seventy years Two years before admission she noticed a slow growing tumor the size of a walnut on the back of her head Eighteen months later it began to grow rapidly and was quite soft On admission there was a soft, elastic, fluctuating, pendent tumor the size of a child's head growing from the occipital region At one part there was an area of ulceration On pressure pulsation was felt At the base one could feel a circular perforation of the skull

The tumor was extirpated and found to spring from the bone The dura was normal Death ten days after the operation Autopsy No metastases The tumor was soft, pale, and marked here and there by reddish areas

Histologically the tumor presented a groundwork of a spindle-cell tissue, supporting numerous gland-like tubules lined with a single and in some places multiple rows of cylindrical cells which could not be distinguished from cylindrical epithelial cells These cells had large oval nuclei situated at the base of the cells Among these high cells there were some cubical and polygonal-shaped cells The lumina of the tubules were in general round Some contained colloid or hyaline material The origin of the tumor was traced to the spindle-shaped cells of the bone marrow, only a portion of which is in relation with the blood capillaries Volkmann concludes that the cells separated from the vessels to form columns and to develop into gland-like tubules with cylindrical cells

CASE 15—MARKWALD, 1895 A male, aged fifty-six years, was taken ill in the spring of 1893 with pains in the back, chest, and joints

By December, 1893, he was weak, his head rested on his chest, and the abdominal vertebræ were bent backward and to the left side. The deformity increased, and the patient died July 2, 1894. At the autopsy nothing of special interest was found in the internal organs. The head and body were cut in sagittal section in the middle line. The brain and cord were normal. The bones of the skull showed a number of small, reddish-brown, soft, very vascular tumor masses. Similar new growths were present in the bodies of most of the vertebræ, in the ilium, and the long bones of the extremities and the ribs. In the latter the tumors were both periosteal and in the marrow. All the tumors appeared to be of about the same age.

Microscopically, the tumors were composed of a connective-tissue stroma rich in capillaries, with cell masses arranged in rows suggestive of carcinoma. The cells had large, round nuclei surrounded with a considerable amount of protoplasm. The cells often formed long rows. Many of the spaces contained blood. The tumors sprang from the endothelium of the small capillaries and were classed as an intravascular endothelioma. The tumor tissue was not circumscribed, but tended to spread.

CASE 16—GAYMARD, 1898. Female, aged nine years. She always had had good health until some months before coming under observation. Five months later she fell from a carriage, striking her head. There was a fracture of the left hip at the trochanter, where a tumor mass was felt. Fifteen days after the fall a small tumor was discovered at the junction of the right frontal and parietal bones. This tumor was soft, and on excision had the appearance of human muscle. Diagnosis: Angiosarcoma of the upper end of the left femur with metastases in the skull. Operation: Excision of the tumor of the skull.

Histologically the tumor was composed of a net-work of vascular tissue, with a delicate connective-tissue framework limiting large alveoli, and between this framework and the vascular spaces containing red blood-corpuscles there were from five to ten rows of round or polygonal cells, thus, a vascular lumen, stratified rows of cells, then supporting connective tissue. Gaymard regarded the cells as endothelial in origin.

CASE 17—RITTER. A female, aged fifty-one years, had pain in the right leg for six months. Three months later there was a swelling of the right leg and foot. Examination showed a fluctuating, pulsating tumor connected with the lower end of the tibia. Operation at the knee-joint. The tumor was spindle in shape, it began 3 centimetres above the ankle-joint, and was 8 centimetres long and 19 centimetres in circumference. Just above the tumor there was an old fracture of the tibia. The periosteum was thickened over the tumor, which in places penetrated the former. On section the tumor was soft and juicy, and of a dark brownish red color. No bone was found in the tumor. No metastases were made out. The tumor was composed of a structure of rather large cells arranged in places in long single rows, in places in solid nests or cords of cells, and in other places, still, in larger and smaller spaces or cavities. In the last case the cells were large, oval,

round, or pointed, and rested against capillary vessels which often contained red blood-cells. There was no *membrana propria*. The large spaces which contained blood were round, oval, or tubular in shape, and often communicated. Their lining cells rested directly upon capillary walls. The cells contained large fat drops, and some a material staining brown with iodine. The protoplasm of the cells was granular. The nuclei were large and stained deeply.

*Origin*—Stated as the perithelial cells.

CASE 18—BERGER, 1900. Female, fifty-eight years old, was admitted to the hospital in November, 1898, with a pulsating tumor and spontaneous fracture of the upper portion of the left humerus. In the previous June she had transient pains in the lower extremities and pain and loss of use of the left arm. On admission there was a pulsating tumor, the size of a mandarin, in the inferior deltoid region. The neighboring glands were not enlarged, the heart and lungs were negative.

*Diagnosis*—Pulsating angiosarcoma of the humerus. Amputation. About two weeks later there appeared a swelling of the left side of the face, which later involved the orbital and frontal regions. At the same time the pains in the lower limbs returned. Some months later a tumor developed in the upper part of the left thigh. In June there was a spontaneous fracture of the superior portion of the left femur. There was pain in the trunk, and on one occasion blood in the urine. The tumors increased in size and the patient was bedridden. The upper part of the humerus, except the head and surgical neck, was destroyed by the growth, which was limited by a capsule which was continuous with the periosteum and separated the tumor from the surrounding soft parts. The tumor was continuous with the medullary tissue of the bone, and was soft, friable, spongy, and of a red-wine color. It contained spaces filled with blood and dark clots.

On histological examination by Dr. Bezançon the tumor was found to be surrounded by a connective-tissue capsule rich in blood capillaries. The tumor proper was composed of alveoli with thin connective-tissue stroma supporting cells of varying size. The thin alveolar walls consisted mainly of blood capillaries from 9 to 10 microns wide, which anastomosed with the vessels of neighboring alveoli, which were sometimes cylindrical, sometimes polygonal, or even round when they were about a lumen. The cells were in the main rather large,—15 to 20 microns in diameter. The cells had clear cytoplasm which stained with neither acid nor basic stains. They contained a single central vesicular nucleus with little chromatin and a large nucleolus. No karyokinesis was observed.

*Origin*—Endothelium or perithelium.

There was a marked likeness to the tumor reported by Gaymard.

CASE 19—STERNBERG, 1901. Female, aged sixty-six years, had pain in the back and knees for fourteen days. She was anæmic and presented the clinical picture of pernicious anæmia, but no blood examination was made. She died two days after admission.

*Autopsy*—The body was poorly nourished, no deformities of the

skeleton The lungs, pleuræ, and heart were negative The liver showed a number of small nodules The gall-bladder and bile ducts were negative, as were all the other organs except certain bones The right femur and humerus, on section, showed scattered, soft, grayish white nodules The sternum, ribs, vertebræ, sacrum, and cranial bones showed similar nodules

Sections of the tumors of the marrow of the various bones showed large round, clear, swollen cells with peripherally placed, half-moon or sickle-shaped well staining nuclei The cell body had a finely granular border, while the inner part of the cell contained one or more vesicles or spaces (fat spaces) In some cells the cytoplasm was transformed into a large vesicle containing finely granular material The cells were supported by a net-work of fine capillaries forming an alveolar arrangement Giant cells were found in some places The tumor cells contained no glycogen No micro-organisms were found

### PERSONALLY OBSERVED CASES

CASL 20 (Case I, HOWARD and CRILE)—*Primary Perithelioma of the Left Humerus ending in Spontaneous Fracture, Non-union of the Fracture Metastasis on the Tip of the Nose Amputation of the Humerus and Tip of the Nose, Death on the third day*

Clinical History (Dr Crile) *Personal History*—The patient was a well-built man, sixty-five years of age, and of a sturdy family without any history of malignant disease He had always been active in business, and in his later years carried heavy responsibilities There was no history of serious illness except several attacks of appendicitis

Two years before the fracture of his humerus he fell down an elevator shaft for two stories without serious injury He had been accustomed to drive a spirited trotting horse, even up to the time of the spontaneous fracture

*Present Illness*—For about two years prior to the fracture he suffered considerable pain in the humerus near the point of the fracture The pain was not influenced by the weather, exercise, or by pressure, neither by treatment While tossing a tennis ball preparatory to serving, his arm suddenly snapped and fell helplessly by his side A temporary dressing was applied by Dr N C Varian, after which he was under the care of his physician, Dr C B Humiston The fracture was transverse and was easily kept in place There was nothing unusual in its clinical course excepting the tardy repair On the second and third weeks there

was a fairly good callus, but later this diminished and almost disappeared. At this time I became associated with Dr Humiston. The tumor of the nose was such as to give the end of that organ the appearance of a greatly exaggerated tippler's nose,—red, tuberosus, elongated, and slightly turned up.

On close inspection the numerous blood-vessels increased in density towards the tip, and faded out upward and laterally. There was neither pain nor tenderness. On palpation a distinct pulsation could be made out.

A diagnosis of angiosarcoma was made, a section, under local anæsthesia, was removed and submitted to Dr W T Howard, Jr, who returned the diagnosis of perithelioma.

The fracture was believed to be due to a similar process in the humerus. At the end of eight weeks the humerus at the point of fracture showed pulsation.

Dr Humiston, assisted by Dr Hain, Dr Fitzgerald, and myself, performed the operations.

The patient bore the operations well, but developed some obscure pulmonary symptoms on the third day and died rather suddenly. No autopsy was made.

The arm and the nose were submitted to Dr W T Howard, Jr, for pathological investigation.

#### Pathological Report (Dr Howard)

(a) Small portion of tissue removed from the tip of the nose by Dr Crile for microscopical examination. The specimen consisted of a small piece of skin and underlying tissue.

On microscopical examination the epidermis was found unbroken, somewhat thinner than normal, but otherwise unchanged. Beneath the skin and entirely unconnected with the epidermis there were a number of large capillaries and blood sinuses of varying size, surrounded by from one to three or four rows of large oval or polygonal cells with faintly staining vesicular nuclei, which usually contained nucleoli. Many of the nuclei showed mitoses. The outlines of most of the cells were very distinct, the cytoplasm was often vacuolar and sometimes finely granular. In many cells it was very obscure. The new growth was not encapsulated and extensively invaded the surrounding tissue. A diagnosis of endothelial hæmangiosarcoma was made, and immediate operation for the growths of both the nose and the humerus advised.

(b) On November 21, the tip of the nose and the left upper extremity of this patient were received at the laboratory

*Nose*—The specimen consisted of the end of the nose, including both alæ nasi, and measured 3 by 3.5 centimetres. At the tip there was an elevated tumor nearly round in outline and projecting from 8 to 12 millimetres above the surrounding skin. At one portion there was a small area of ulceration, and at another a globular protuberance .5 centimetre in diameter.

On section the tumor was 1.5 centimetres wide and 8 to 10 millimetres in depth, and of a grayish pink color. Its margins were irregular. At one point the tumor approached but did not invade the cartilage of the nose. The skin and underlying tissues were otherwise unaffected.

Portions of tissue were hardened in Orth's and Zenker's fluids and in alcohol, and stained with hæmatoxylin and eosin, eosin and methylene blue, and Weigert's elastic tissue stain. Sections through the whole growth showed that it was covered with unbroken skin, except at one point where the epidermis was entirely lost, the underlying tissue was infiltrated with red blood-cells, leucocytes, and plasma cells. At this point the tumor was from 1 to 2 millimetres beneath the surface, from which it was separated from the necrotic and infiltrated dermis by a thick layer of fibrous tissue. The new growth was in no way connected with the epidermis or the glands of the skin. It was surrounded by a rather dense fibrous tissue which it infiltrated on all sides. The tumor was separated into a number of well defined but irregularly oval areas by dense, white fibrous tissue bands, which were poor in nuclei and blood-vessels. The new growth was composed of a large number of capillary and venous spaces containing red corpuscles and lined by from one to four or five or more layers of large, round, oval, or polygonal cells with faintly staining nuclei. Here and there were larger and smaller spaces without visible lumina filled with large, flat cells like endothelial plates. Large blood sinuses lined with a single or double row of cells were numerous. No elastic tissue was found in the tumor.

*Arm*—The specimen consisted of the left upper extremity. The forearm, hand, and fingers were normal. The arm measured 54 centimetres in length. In its middle third there was a tumor involving the whole thickness of the humerus, the periosteum and a portion of the muscles for a distance of 10 centimetres.



The skin was normal. The tumor was 15 centimetres in its greatest diameter. The muscles were irregularly invaded, the periosteum could not be made out, and a few spicules of bone represented the remains of the shaft of the humerus throughout the extent of the tumor. The marrow cavity, as well as the bone, periosteum, and muscles, was transformed into a homogeneous, pale, grayish-red tissue of a soft spongy consistency. A small amount of blood escaped on section. There were no cysts. The edges of the bone at the upper and lower borders of the growth were rough and irregular, but firm. The new growth invaded the marrow cavity for some distance above and below the main portion of the tumor. The head of the humerus was normal. The elbow-joint contained a small amount of clear fluid. Cultures from the tumor remained sterile.

Small pieces were cut from the various portions of the new growth, and from the humerus and its bone marrow and hardened in Zenker's and in Orth's fluids. Sections were stained with hæmatoxylin and eosin, methylene blue and eosin, with and without Weigert's elastic tissue stain, and with Mallory's connective-tissue stain.

The new growth was composed of a groundwork or supporting tissue, of sometimes thin and sometimes thick branching bands of rather dense white fibrous tissue. In some places, especially where the growth was invading neighboring tissue, the supporting tissue had a hyaline, homogeneous appearance and contained relatively few elongated nuclei. No elastic fibres were found in this tissue.

The essential structures in the new growth were, however, numerous capillaries and sinuses of varying size containing a varying number of red blood-cells. These spaces were lined with from one to five rows of round, oval, or polygonal cells, with faintly staining and often vesicular nuclei, which often contained nucleoli. Nuclear figures were plentiful.

The cell walls were very prominent, while the cytoplasm was often indistinct and did not take the eosin stain. It was commonly finely granular and often vacuolar. The cells were often arranged in regular rows like glandular epithelium, and in this case were commonly columnar in shape, with their nuclei situated at the end of the cell furthest from the lumen. The tumor cells varied from 8 to 15 microns in diameter.

The blood spaces varied greatly in width, some being filled by a single red blood-cell on edge, while others were from 20 to 30 or even 200 microns in diameter. In some places the growth was alveolar in structure, there being no lumina, but the spaces completely filled with cells of the endothelial type. There was rather free communication between the blood spaces, which varied from long tubules to round spaces. The tubular structures ran in various directions. On cross-section they closely resembled gland ducts lined with cubical or columnar epithelium. In many places, especially where several spaces opened into each other, typical papillary processes were seen. They were composed of a thin layer of supporting fibrous tissue, covered with a single layer of cells.

The absence of a *membrana propria* was striking, the cells being in direct relation with capillary walls or with the supporting connective-tissue bands. A capillary could usually be traced between the neighboring or adjacent tubules or alveoli, the cells of which abutted the vessel. The spread of the new growth could be readily traced from the cells lining the blood spaces. In many places at the margins of the growth single and double rows of these cells could be traced making their way far out into the neighboring tissue. All gradations could be made out between these cells and the tumor cells. While the relations of the new growth to the capillaries were intimate, positive proof of the origin of the tumor cells from the vascular endothelium was not obtained. The new growth could not be traced to the lymphatic structures, either. The tumor is therefore in all probability to be classed among the so-called peritheliomata whose histogenesis will be discussed later. As the growth advanced, the surrounding tissue, whether bone marrow, bone, periosteum, muscle, or connective tissue atrophied and was infiltrated. The head of the humerus was not invaded. No newly formed elastic tissue was found in the tumor.

A small amount of blood pigment was present in the tumors of both nose and bone. Tests for glycogen were negative.

These growths were identical in structure. From the clinical history and the study of the tumors there is little doubt but that the nasal tumor was a metastasis for that of the humerus. It is much to be regretted that an autopsy was not granted.

CASE 21 (Case II, HOWARD and CRILE)—*Primary Peri-*

*thehoma of the Left Humerus with Metastases of the Left Temporal Bone, the Pleuræ, Lungs, and Liver* E S, male, aged thirty-one years, white, single, a patient at the Cleveland City Hospital, service of Dr C F Hoover

In January, 1899, he had a spontaneous fracture of the middle third of the left humerus. The bone apparently knit, but nine weeks later a second fracture occurred at the same place. Shortly after the first fracture the patient noticed a small nodule over the right temporal bone. He died of exhaustion, August 2, 1899, about seven months after the first fracture of the humerus.

*Autopsy*—The body was markedly emaciated. The middle third of the left humerus was the seat of a large, soft, grayish red tumor. Occupying the space between the left orbit and the left ear there was a large tumor the size of an orange. The latter growth was continuous with the temporal bone, which was soft and friable. This tumor was soft, grayish-red in color, and quite vascular. The surface of the body and the other bones as far as could be determined were free from metastases. Metastatic nodules from 2 to 10 millimetres in diameter occurred in both pleuræ, both surfaces of the diaphragm and in both lungs, and on the superior surface of the liver. The bronchial glands and mediastinal tissue were extensively invaded. The other organs were without present interest.

*Histological examination of bone tumor*. Sections made from various parts showed very much the same appearances. The bone tissue was largely replaced by a new growth composed of a fibrous tissue stroma which, in general, was quite thin, often consisting mainly, and sometimes entirely, of single narrow blood capillaries, forming alveolar spaces, which were filled with cells of varying shape and size. In most places the cells lay in direct relation with the capillary walls, which to a great degree formed the boundaries of the alveolar spaces. The latter were round or oval in outline and from a few to 200 or 300 microns in diameter. The cells were from 8 to 16 microns in diameter, and were round, oval, or polygonal in shape. Often they formed large flat plates like endothelial cells. They were often placed in long rows, but only occasionally could a lumen be made out. No columnar cells were found. Many giant cells were present in some places. The cells had large, oval, vesicular nuclei, each with a nucleolus. The

cytoplasm was finely granular and stained well with eosin. The cells were intimately connected with the capillaries. The bone disappeared before the advancing growth. This tumor in structure is a typical example of the so-called perithelioma of Hildebrandt.

The metastases of the pleuræ, lungs, and liver showed a structure identical with that of the original tumor.

*Diagnosis*—Primary so-called perithelioma of the left humerus with metastases of the left temporal bone, the pleuræ, lungs, and liver.

CASE 22 (Case III, HOWARD and CRILE)—*Primary Endothelioma springing from the Lymph Spaces and Channels of the Lumbar Vertebrae, Clavicle, and Ribs, with extensive Metastases Chronic Cholecystitis with Gall-stones and thickening of the Gall-bladder*. I. M., male, white, aged forty-five years, entered the Lakeside Hospital, service of Dr. Edward F. Cushing, June 16, 1901, complaining of pain in the left side and back. His family history was negative. He denied syphilis and gonorrhœa. He had always been well until seven weeks before admission, when he was taken ill with pain in the abdomen, left side, and back. His bowels were constipated. The pain was worse at night and ran up and down the back. He was treated by his physician for lumbago. He said he passed less urine than formerly. The patient recalled having had a fall on January 1, 1901, but says he felt perfectly well afterwards until the present illness.

On admission, examination of the heart, lungs, liver, and abdomen were negative. There was no disturbance of the sense of temperature. The spinous processes of the third and fourth lumbar vertebrae were more prominent than normal, and pressure on the lumbar muscles caused great pain. Turning in bed and walking were accomplished with difficulty. In walking, the legs were dragged along with a shuffling gait. In stooping, the back was held rigid. When the head was tapped, sharp pain was felt in the lumbar region.

The urine was clear, of an amber color, sp. gr. 1030, acid, free from sugar. No albumen (albumose not recorded). No casts, a few leucocytes. The patient ate little and steadily declined. On July 5 a small subcutaneous nodule was noticed on

the right side just below the ribs in the posterior axillary line. Later, a similar nodule appeared on the opposite side.

On July 20, a painful swelling of the sternal end of the left clavicle was noticed. Blood examination, July 17, showed leucocytes 10,000 per cubic millimetre, hæmoglobin, 89 per cent. July 21, the leucocytes were 22,000 per cubic millimetre. The patient died July 29, 1901, after having been comatose for three days.

Autopsy two hours after death.

Abstract of the autopsy protocol. The body was 165 centimetres long and very much emaciated. On the left sternoclavicular articulation there was a well-marked tumor mass. The joint was movable and crepitant. Small subcutaneous nodules were present on the chest, abdomen, back, and left buttock. On section they were firm, translucent, and glistening. The sternum, costal cartilages, and mediastinum were negative. The tumor of the left clavicle was firm and translucent and grayish-white in appearance. Similar masses were present in the third and fourth ribs of the right side.

The bodies of the third and fourth lumbar vertebræ were softened and cut with comparative ease, the bone tissue was almost entirely replaced by a grayish-white translucent tissue. The body of the second lumbar vertebra contained an oval nodule 2 by 12 centimetres in diameter, and of a similar appearance. The bodies of the third and fourth lumbar vertebræ were flattened, the periosteum thickened, and in places extensively involved in the tumor tissue. This was especially well marked on the posterior surface of the bones where the tissue was soft and readily compressed. The spinous and transverse processes of the third and fourth lumbar vertebræ were thickened and extensively invaded with tumor tissue. A mass of tumor tissue, 2 by 1 by 1.5 centimetres projected from the spinous process of the third lumbar vertebra into the spinal canal and compressed the cauda equina. The dura was not affected, but the canal contained a large amount of clear fluid. A similar but smaller mass was found opposite the fourth dorsal vertebra, the cord was not compressed at this point. The left psoas muscle, near the bodies of the second and third lumbar vertebræ, was the seat of an irregular tumor mass 3 by 2.5 centimetres in diameter. On section this mass was found to be directly continuous and identical

in structure with the new growth of the vertebræ. As far as could be determined, no other bones were affected. Examination of the brain was not allowed.

The vascular system showed nothing abnormal. A few small nodular masses were found in both lungs. The peritoneal cavity contained 2500 cubic centimetres of greenish yellow fluid. The peritoneum over the intestines was studded with numerous small pale elevated nodules. The liver weighed 1650 grammes. The surface was covered with numerous pale elevated areas from 0.25 to 0.5 centimetre in diameter. The ligaments were thickened and contained similar nodules. On the extreme right border of the liver there was a firm nodule 5 x 3 centimetres. On section the organ was bile stained, and was studded with numerous brown or yellowish, firm, small areas which were sharply defined from the liver tissue. The lobules were visible. The bile ducts were dilated.

The gall-bladder was quite small and its walls very much thickened. On section the walls were dense and firm, the cavity much reduced in size, and contained fifty-five yellowish-brown stones. The mucosa was red, but showed no special thickening and no evidence of tumor formation. The hepatic duct was dilated, the cystic and common ducts normal.

The lumbar, mesenteric, gastrohepatic, peripancreatic, and bronchial lymph-glands were large, firm, and translucent on section. They were extensively invaded by metastatic growths.

The other organs are without present interest.

The tumor was evidently primary in the lumbar vertebræ (possibly the ribs and clavicle), whence metastases occurred by extension into the surrounding tissue (psoas muscle), thence to the lumbar and mesenteric and other lymph-glands, the peritoneum, liver, and lungs.

The macroscopical resemblance of the tumors to carcinoma was striking.

*Histological Examination*—Sections of the bones. Bodies of lumbar vertebræ. Sections from the centre of the growth show dense, fibrous tissue stroma rather scantily supplied with blood capillaries containing a variable number of spaces filled with large cells. The cells in places formed long rows, sometimes single, but usually double or even treble. In other places there were round or oval alveolar spaces filled with cells. No lumina

were to be seen. Between the cells, both in rows and in alveoli and the stroma in most places, a definite row of thin flat cells in all respects like the endothelial plates of lymph spaces and vessels could be seen. In a number of instances the development of these lining cells into the tumor could be traced, this occurred by the swelling of both nuclei and cytoplasm, with the transformation of the thin plates into large cells, with swollen vesicular nuclei. The tumor cells varied very much in size, from that of a polymorphonuclear leucocyte to huge multinuclear giant cells. They were usually polygonal, but sometimes round, often oval, and in many cases, especially when lying in single rows in narrow lymph spaces, very much elongated. In general they were large cells. The cytoplasm was smooth or finely granular, and stained faintly with eosin. The nuclei were large and vesicular, with well-marked rims, and contained one or more nucleoli. In many of the large cells from three to six nuclei could be made out. Nuclear figures were numerous. Nuclear and cell inclusions were not uncommon. In sections at the advancing border of the growth in bone the origin of the tumor from the endothelium of the lymph spaces and vessels, especially the perivascular lymph spaces, was evident. Here in the soft bone marrow large alveoli of tumor cells were numerous. Following the proliferation of the endothelial cells of the lymph spaces and lymph vessels there was a growth of dense fibrous tissue. The advancing border of the growth was much more cellular and softer than the older portions. With the growth of the fibrous tissue, stroma resorption of bone occurred.

In sections made through the fourth lumbar vertebra and its periosteum and the surrounding tissue, the spreading of the tumor tissue to the latter could be clearly seen. Sections made from the new growths of the clavicle and ribs showed the same structure described in the vertebræ, except that a better opportunity was given for the study of the origin and spread of the tumor tissue, which could be readily traced from the endothelium of the lymph spaces and lymph vessels, especially from the perivascular lymph spaces.

Lymph-glands, mesenteric and bronchial. In the sections studied, the lymphoid tissue was almost entirely replaced by a new growth made up of large and small alveoli filled with large

cells with large vesicular nuclei. Nuclear figures were numerous. No tubular formations were found.

*Liver*—Scattered throughout the liver there were a large number of small metastases situated near the portal systems. They showed the same structure as elsewhere, but the tumor cells were crowded together more closely than in other organs. The liver-cells in many places were shrunk, compressed, and contained a large amount of pigment. In the portal systems which were not involved in the tumor metastases, the bile ducts and the portal connective tissue contained a considerable amount of bile pigment.

Sections of the gall-bladder showed desquamation of the lining epithelium, with dilatation of many of the glands and desquamation of the glandular epithelium. In many places the glands were absent. The wall of the gall-bladder much thickened by the presence of a dense fibrous tissue with scattered areas of round-cell infiltration. No tumor was to be made out, though numerous sections from various parts were examined.

*Lungs*—In sections of the lungs the metastases were found mostly above the small bronchi, involving the pulmonary vessels, the peribronchial tissue, and often groups of tumor cells were found in the alveoli. In some places subpleural metastases were found. The pulmonary metastases showed the same structure as the original tumor and the other metastases.

Sections of the omentum showed extensive metastases always along the lymph channels and spaces.

*Heart*—Sections of the heart muscle (left ventricle) showed a small metastasis. The spleen and pancreas were negative. The kidneys were the seat of chronic interstitial nephritis.

A study of the gross and microscopical lesions showed clearly (1) That the lumbar vertebræ were the primary seat of the new growth, (2) that the tumor spread first through the vertebræ to the surrounding tissue, thence by the lymphatics to the lumbar and mesenteric lymph-glands, the omentum, the peritoneum, and the hepatic lymph-glands, thence to the liver, lungs, heart, clavicle, and ribs. (3) The new growth was an endothelioma springing from the endothelial cells of the lymph spaces and vessels of the lumbar vertebræ.

*Anatomical Diagnosis*—Primary endothelioma of the third and fourth lumbar vertebræ, with metastases in the perivertebral



tissue, the left psoas muscle, the lumbar, mesenteric, and bronchial lymph-glands, the omentum, peritoneum, liver, lungs, heart, clavicle, ribs, and sternum Slight fibroid tuberculosis of the lungs Chronic cholecystitis, with gall-stones, and thickening of the gall-bladder Cultures from the lungs showed *Staphylococcus pyogenes aureus* and *Bacillus mucosus capsularis*,—other organs negative

CASE 23 (Case IV, HOWARD and CRILE)—*Primary Lymph Endothelioma of the Left Femur, with Metastasis in the Inguinal Lymph-Glands Autopsy not obtained*—Female, aged eleven years Consulted Dr Costello, July 15, 1901, complaining of pain in the left femur just above the knee-joint There was no history of tumors in her family The father and mother and several brothers and sisters were well No history of tuberculosis or syphilis was obtainable The child had had both measles and scarlatina The child walked into Dr Costello's office with a slight limp There was no increase of pain on walking, bending the knee, or on pressure On percussion there was deep-seated pain There was slight symmetrical swelling of the left thigh just above the knee Pulsation was not noted On questioning the child, she stated that about June 1 she had a fall while playing in the school-yard Examination by Dr Costello showed a small abrasion of the skin below the point of swelling There was no noticeable enlargement of the inguinal or other lymph-glands The temperature was 99° F, the pulse normal *Diagnosis*—Osteomyelitis

Operation, July 17, by Drs Gallagher and Costello A longitudinal incision was made through the skin and soft parts, about five inches in length, on the outer surface of the left femur, at the point of swelling, and extending through the periosteum The subcutaneous tissue was entirely normal in appearance The periosteum appeared somewhat thickened, but not noticeably congested The bone was firm but appeared thickened About a teaspoonful of puriform(?) material was obtained from the marrow cavity The wound was packed with gauze There was no discharge of pus About two or three weeks after the operation there was a slight uniform swelling of the lower end of the thigh Very exuberant granulations formed in and about the sinus which persisted six weeks after the incision The thigh became progressively larger, until by November it was the size

of a bucket, the swelling being uniformly round in outline and extending from the knee to near the hip-joint. The inguinal glands became swollen and tender, but no other glands were involved, and no other tumors were apparent. There was no pulsation of the tumor. Springing from the seat of the incision there developed a globular tumor mass the size of a man's head and uncovered by skin over a considerable area. Pain was marked. There was no fracture. She was seen by Dr. Crile in consultation in November.

Sections made from the piece of tissue excised by Dr. Crile showed a dense fibrous tissue stroma supporting occasional strands and alveoli of cells. Many alveoli were large and contained thin elongated cells. Some of the cellular strands were quite long.

The cells were large, of the endothelial type, and had rather large nuclei. Many of the cell collections were evidently in lymph spaces, from the lining cells of which their origin could be readily traced. The alveoli were evidently formed by the multiplication of the endothelial cells of these spaces. The blood-vessels took no part in the new growth.

#### GENERAL PATHOLOGY

(a) Analysis of the 23 known cases shows as follows

*Seat*—Long bones were involved in 19 cases (humerus 7, tibia 3, femur 8, ulna 1), all the long bones, 1, flat and spongy bones in 15 cases (most of skull bones 1, base of skull 2, temporal and frontal bones 2, iliac bone 2, sternum 4, vertebræ 4).

*Size*—The tumors were large in 11 cases, of moderate size in 7, and small in 5 cases.

Thirteen were said to be soft, 5 hard, and 5 elastic.

On section, the prevailing color was red or gray red.

Cysts of varying size, usually containing bloody fluid, were found in 8 cases. Of the 16 cases involving the long bones, spontaneous fracture occurred in 7.

In most cases the growth started in the central portion of the affected bone, spread along the marrow cavity, through the bone, and in several cases into the surrounding tissues.

The tumors were quite vascular, and several of the older cases were mistaken for bone aneurisms, seven were said to pulsate.

Metastases occurred in over one-half the cases (14)

In 8 cases the tumors were single and without apparent metastases

In the 13 cases in which multiple tumors are known to have been present, in only 4 were the bone tumors single. In these 4 cases (Engelmann, Jaffé, von Lukovicz, our Case I), the lungs and pleuræ showed metastases in 3, the primary growths being in the sternum and ribs, left os ilium, and left femur each in 1 case, in the fourth case a primary tumor of the left humerus gave rise to a secondary growth on the nose.

In the remaining cases there were multiple growths in several bones, with metastases in some of the internal organs in 4.

A synopsis of these 9 cases shows as follows. Sudhoff's case, multiple tumors of the dorsal, lumbar, and sacral vertebræ, sternum, and left femur, Spiegelberg's case, right os ilium, a metatarsal bone, sternum and ribs, Marchwald's case, skull, most of the vertebræ, ossa ilia, ribs, and long bones of the extremities, Gaymard's case, left femur and skull, Berger's case, left humerus and femur and the skull (frontal bone), Sternberg's case, right humerus and femur, the sternum, ribs, and several vertebræ, Zahn's case, skull, vertebræ, and ribs, our second case, left humerus and the skull (left temporal bone), our third case, the lumbar vertebræ, clavicle, and ribs. Certain bones were affected with great frequency, the bones of the skull, the vertebræ, the sternum, the ribs, and the femur being the ones most often involved.

Certain combinations of bones stand out prominently, for instance, the skull, the vertebræ, and the ribs, and sometimes the sternum being affected together. The humerus and the femur were simultaneously affected in two cases. In some of these cases it is pointed out in the clinical histories that the tumors apparently involved certain bones after others, but in some instances the tumors of the various bones appeared about the same time and were of apparently the same age. For some cases, at least, it seems not improbable that the tumors started in several bones at the same time, that is, that a number of independent malignant tumors of the same structure originated simultaneously in different bones. Opposed to this view are the fact that malignant tumors rarely originate in multiple foci and the probability that the bone tissue offered a more suitable soil for the growth

of wandering tumor cells than certain other organs to which the cells were also carried. In two of these cases the visceral metastases were inconspicuous, while in the remaining two cases they were wide-spread.

The other five cases of multiple wide-spread tumors of bones, like the myelomata, failed to show visceral metastases and the presence of tumors except in bone. Eleven cases are known to have died, in all but one of these an autopsy was obtained. The growth was rapid in nine cases. The growth of the tumors, when small and not involving the viscera, was associated in many cases with prostration and the usual symptoms of emaciation and cachexia. No special blood changes have been noted. Albumosuria was not mentioned in the histories of any of the cases, and was probably not looked for.

*Histology*—The histological descriptions of the earlier cases are not very full, but a conformity to two general types is clear, (a) vascular tumors with alveoli filled with cells of various types, and (b) gland-like structures lined with single, double, or multiple rows of round, oval, polygonal, or even columnar cells of the epithelial type. In some tumors there were both alveolar and tubular structures. Giant cells may be present in both varieties. In both types the relation between the tumor cells and the blood capillaries is usually intimate and conspicuous. In many cases the tumor cells lie against the capillaries, which course between rows of the former. The blood capillaries may contain much or little blood, often they are compressed by the tumor cells. The alveolar walls are in many instances composed entirely of capillaries, while in others the tumor cells are supported by an abundant fibrous tissue stroma. The latter was especially well marked in our Case 3. The gland-like structures—tubular endo- and perithelioma—often form long tubules, and may contain blood. In some tumors the fibrous tissue was scanty, while in others it was plentiful and rich in nuclei and spindle-shaped cells. As far as is known, it is composed of white fibrous tissue. The tumor cells are prone to degeneration, and there are instances of fatty, colloid, hyaline, and myxomatous change. Ritter and Driesen demonstrated glycogen in the tumor cells in their cases. The iodine test for glycogen was negative in our Case 1.

Many of the tumors in bone were not sharply marked off from the marrow tissue. The histological structure is entirely

unlike that of myeloma, from which it is readily distinguished. The cells and their arrangement, however, differ rather widely, and this is readily understood when their diverse points of origin are considered.

(c) *Histogenesis*—From analysis of the cases available at the date of his article, Volkmann concluded that these tumors had their origin as follows ,

From the endothelium of the lymph sinuses, 4 cases (Lucke, Driessen, Engelmann, and von Lukowicz), from the endothelium of blood capillaries and the perithelial cells, 6 cases (Kocher, Kolaczek, Hildebrandt, Zahn, Jaffe, and Billroth), from the endothelium of lymph channels and blood capillaries, 2 cases (Schweiningher and Volkmann), unclassified, 1 case (Sudhoff)

While we do not believe that it is possible to accurately classify these cases according to their histogenesis, a careful study of each leads us to think the following is approximately correct, and as near the truth as it is now possible to arrive. From the perithelial cells of Waldeyer, or the endothelium of perivascular lymphatics, 12 cases (Lucke, Kocher, Billroth, Jaffé, Hildebrandt, Gaymard, Ritter, Berger, Sternberg, and Howard and Crile, Cases I, II, and V), from the endothelium of blood capillaries, 2 cases (Zahn and Markwald), from the endothelium of the ordinary lymph vessels and lymph spaces, 7 cases (Engelmann, Kolaczek, von Lukowicz, Driessen, Spiegelberg, Volkmann, Howard and Crile, Cases III and IV), from the endothelial lining either of the blood capillaries or the lymph vessels, two cases (Sudhoff and Schweiningher). If the above is correct, one-half of these tumors are perithelial in origin, while the other half are derived from either the blood or the ordinary lymph-vessel endothelium. The term perithelioma was first applied to certain of these tumors by Hildebrandt. That the tumors in question arise from the perithelial cells of Waldeyer, cells found in relation with the small blood-vessels of certain organs, notably the testis, is by no means proven. As Driessen points out, these cells have not been demonstrated about the blood-vessels of either bone or periosteum. Morphologically, the cells of these tumors are of the endothelial type, and like endothelial cells they lack apparently the property of secreting intercellular substance. Hence it is fair to conclude that they are not of the ordinary connective-tissue type. This being so, it is evident that the tu-

mors classed as peritheliomata must take their origin from either the endothelium of blood capillaries or from the endothelium of the perivascular lymph spaces

That tumors of the same structure as the so-called bone peritheliomata may arise from the endothelium of blood capillaries, we have had recent evidence in an endothelioma of the breast removed by Dr Crile, in which there were both closely filled alveoli and tubular structures often containing blood and corresponding exactly with the structure of the tumors of our Cases 1 and 2, which would be classed among the peritheliomata by Hildebrandt and others. In this breast tumor some of the blood capillaries were more or less completely filled with proliferated endothelial cells. In other places the mode of development of the tubular structures could be directly traced from proliferated blood capillary endothelium, the newly formed cells protruding from the capillaries, and forming short or long rows in the surrounding, but otherwise unchanged, connective tissue. The perivascular lymph spaces played no apparent part in the process. The presence of blood in the spaces of the so-called peritheliomata does not prove that these tumors spring from the blood-vessel endothelium, for its presence is readily explained by hæmorrhage, large areas of which are not uncommon, contrariwise, the absence of blood in the spaces cannot be taken as an argument against the blood-vessel endothelium as the origin of certain of these growths.

We are inclined to agree with the opinion of Driessen, Perth, Hildebrandt, and others that the so-called perithelium is in reality the endothelium of the perivascular lymph spaces.

We have not been able to make out in sections of bone marrow any cells which could be classed as the perithelial cells of Waldeyer. In the bone marrow the blood capillaries show no such cells, and are not accompanied by perivascular lymph spaces, which can, however, be made out about the small arteries and veins. Hence we would include among the so-called bone peritheliomata those tumors springing from these cells, as distinguished from the lymph endotheliomata derived from the endothelium of the ordinary lymph spaces and lymph vessels, *i e*, those not immediately about the blood-vessels. Judged by the study of our own material, derived from tumors of bone and other organs it is not possible in most cases to decide whether

a given tumor springs from blood-vessel endothelium or perivascular lymph space endothelium (perithelia)

Apparently, there may develop from the endothelium of either of these two places growths of identical structure, that is, the endothelium of either situation may give rise to endothelial cell growths composed of either completely filled alveoli or of tubular spaces (with or without blood-cells in the latter) in which both alveoli and tubular spaces are separated and supported by blood capillaries in direct relation with the tumor cells. The chief difficulty in diagnosis here is due to the fact that growths developing from blood capillary endothelium may form alveoli by proliferation inside the vascular lumen, the alveolar boundaries being furnished by previously existing or newly formed capillaries, or the proliferating endothelial cells may break through the blood capillaries and form either tubular or alveoli structures. Unfortunately, these tumors are not presented for examination in their earliest stages, and one cannot say whether a growing portion of the tumor is derived from the cells of the vessels or spaces in which proliferation is taking place, or the proliferating cells are transported tumor cells from older portions of the growth.

At the present time we cannot certainly distinguish but two varieties of endothelioma of bone (1) those derived from the endothelium of blood-vessels and perivascular lymph spaces, and (2) those springing from ordinary lymph vessels and spaces, and not immediately connected with blood-vessels. Of our own four cases, Nos I and II belong to the first and Nos III and IV belong to the second variety. These two varieties of tumor are characterized by unmistakable differences. The first, with their multiple rows of cells in alveolar or often in tubular arrangement, sometimes containing blood and always bounded by blood capillaries, stand out in marked contrast to the larger and smaller alveolar collections of cells which more or less completely fill the lymph spaces and lymph vessels from which their origin is so readily traced.

The second variety of bone endothelioma much resemble carcinoma in macroscopical and in microscopical appearances, and no doubt the cases of so-called primary carcinoma of bone belong to this group.

Borrmann's division of these tumors into two classes—peri-

theliomata and peri-endotheliomata, the first with a radial perpendicular and the second with a concentric arrangement of many layered superimposed cells about the vessel walls—is of doubtful value. The endotheliomata of bone dealt with in this article are not to be confounded with the so-called tubular perivascular sarcomata, types of which are the cases recently reported by Low and Lund.

Of the single bone tumors forming metastases in the other organs, two, as said before, had their origin from the perithelium, and two from the endothelium of lymph-space vessels. The nine cases of multiple bone tumors had their origin as follows: perithelium or blood-vessel endothelium, 6; endothelium of ordinary lymph spaces and vessels, 2; blood or lymph vessels, 1. Both of the tumors thought to be derived from the capillary endothelium and four of the peritheliomata formed multiple bone tumors, and a majority of the peritheliomata showed multiple growths.

*Etiology*—Sex is without much influence, 12 cases were in males, 10 in females, and 1 sex was not recorded. These tumors occurred once each at 9, 11, 18, 25, 31, and 52 years, there were 5 cases between 40 and 50, 5 between 50 and 60, and 7 cases over 60 years. A history of previous injury was obtained in 6 cases. Further than this nothing definite is known of the cause of these growths. Without wishing to lay too much stress upon the observation, we must say that in studying sections of our Case III we were impressed with the readiness with which the proliferation of the endothelium of the lymphatics would be explained by the assumption of the action of micro-organisms or their toxins. As was necessarily the case, pictures were seen which were quite similar to those seen in the lymphatics in typhoid and other processes as pointed out by Mallory. In this connection, it is also of interest to recall the observations of the proliferation of endothelial cells of lymphatics with the formation of tubules by v. Notthaft and considered by him due to an infection in a case of pseudo-leukæmia, and the conclusions drawn by Boivard by which he excludes tumor formation in his case of splenomegaly with proliferation of the endothelium of the lymph sinuses of the spleen, abdominal lymph-glands, and peribular lymph channels of the liver. In our own case we were struck with the idea that had micro-organisms or their toxins acted on these endothelium of the lymph vessels and sinuses, identical



changes must have been produced. Micro-organisms and bodies which might be taken for them have not, however, been observed in these growths. It is to be hoped that the attention that endothelial cells are now receiving may soon throw some light upon the etiology of these growths.

*Relation of endo- and peritheliomata to bone aneurisms.* Pulsation of the tumors was noted in seven cases. Hildebrandt, who has carefully reviewed the subject of the relation of bone aneurisms and malignant tumors of bones, concludes that true bone aneurisms are rare, and that a pulsating bone tumor is to be regarded as malignant, probably sarcoma. Roughton, who has recently written on the subject, reaches the same conclusion.

#### CLINICAL (DR CRILE)

The clinical history and aspects of endo- and peritheliomata of bone present in general a similarity to the general type of osteosarcoma. Certain differences and a few well defined distinctions are apparent on closer study. The number of cases collected (23), which for the purpose of a more minute analysis might readily be said to be insufficient, reveals in certain directions a persistence of a few distinct characteristics, so that a deduction from this compilation of the symptoms, course, and termination of these neoplasms may be fairly assumed to accord with their general clinical anamnesis.

*Sex.*—In the foregoing tabulation of endotheliomata of bone, the sex is given in twenty-two cases, of which twelve were males and ten females. This proportion is not in correspondence with that found by Gross in sarcoma of bones. In a collection of 149 cases of osteosarcoma, he found that men were by 17 per cent more frequently affected.

*Age.*—In marked variance with sarcoma in general is the age at which endo- and peritheliomata of bone are found to occur. In ordinary sarcoma of bone, although no age is exempt, children and young adults are most frequently affected. Butlin states that young adults of both sexes, from fifteen to twenty-five years of age, are much more liable to the disease than persons at the extremes of age, while, according to Volkmann, osteosarcoma usually develop during the growth of the individual, most commonly about the twentieth year, very rarely after the fortieth. Gross, in a tabulation of 147 cases of osteosarcoma in which the

age is given, found that in 68 per cent these tumors developed before the thirtieth year, and in 32 per cent after that period. From his table it can moreover be ascertained that 85·7 per cent of these growths occurred before the fortieth year and but 14 per cent after that time. Paget, in a collection of nineteen cases of osteosarcoma of various bones, reports the following

In five cases	the growths occurred at the age of	10 to 20 years
In nine	"	"
In four	"	"
In one case	"	"

To this table may be opposed that of bone endotheliomata, the comparison between the two from the similarity of numbers in both being the more striking. In a tabulation of the cases of bone endotheliomata with respect to age, one finds that

In one case	the growth occurred at the age of	9 years
In one	"	"
In one	"	"
In one	"	"
In one	"	"
In one	"	"
In one	"	"
In four cases	"	"
In three	"	"
In six	"	"
In two	"	"

In this tabular arrangement it is to be noted that but five cases, or 26·13 per cent of bone endotheliomata, occurred before the age of forty and 14 cases, or 73·87 per cent, after that period, while in the table of osteosarcoma of Paget, 18 cases out of 19, or 95 per cent, are found to have developed before the fortieth year, and but one case, or 5 per cent, between the fortieth and fiftieth year. In Gross's collection of 147 cases, as already mentioned, 85 per cent occurred before the fortieth year, and 15 per cent after that period. In summary

Before the Fortieth Year	After the Fortieth Year
Paget's table (osteosarcoma), 95 per cent	5 per cent
Gross's table (osteosarcoma), 85 "	15 "
In endotheliomata of bone, 26 per cent	73 "

As to the age, bone endotheliomata are at variance with osteosarcomata, and in accordance with carcinomata

*Cause*—In the majority of the cases there is no apparent cause. Among the cases in which the occurrence of trauma is mentioned in connection with the appearance of tumor is that of Kocher, in which a pulsating tumor with a systolic bruit developed eight months after an injury from a flail in the right frontotemporal region. In Hildebrandt's case, a male, forty-five years of age, the endothelioma was found in the lower part of the arm above a fracture of the right elbow which had been sustained in childhood. Similarly, in the case of Ritter, a female, fifty-two years old, bore the evidence of an old fracture of the tibia, above which was situated the tumor. In another case presenting primary endothelioma in the clavicle, ribs, lumbar vertebræ, the patient had sustained a fall six months previously. As a whole, injury cannot be stated to be an etiological factor of much importance.

*Bones Affected*—The predilection of endotheliomata of bone like that of osteosarcoma is for the long bones of the appendicular skeleton. In the 23 cases collected, the exact position of the primary involvement is given in 20, in the other three cases a number of bones were found to have been involved, and the seat of primary origin is either not mentioned or could not be definitely determined. The various bones were affected as follows:

Humerus, 5 times, ulna, 1 time, iliac bones, 1 time, femur, 4 times, tibia, 3 times, head, 3 times, vertebral column, 2 times, sternum and ribs, 1 time, other bones, 3 times.

The appendicular skeleton was involved in 14 cases, the axial skeleton in 6 cases—a proportion of approximately 2

1. In the appendicular skeleton the upper extremity was affected six times, the lower extremity eight times. Deducting the one case in which the iliac bones were the seat of the malignant growth, it is seen that the long bones of both the upper and lower extremity were equally affected. The single bone most frequently affected is the humerus, there being five cases out of 20, or in 25 per cent. Femur and tibia are next in the order of frequency, each being involved four times, or in 20 per cent.

In osteosarcoma the favorite seat of these malignant growths is the femur and tibia, with by far the greater preponderance in favor of the former, as can be gathered from the table of Gross. Out of 165 cases analyzed,

The femur was the seat of the disease in 67 instances				
The tibia	"	"	"	46 "
The humerus was the seat of the disease in 25 instances				
The fibula	"	"	"	13 "
The ulna	"	"	"	7 "
The radius	"	"	"	6 "
The radius and ulna were the seat of the disease in one instance				

Volkman, in writing of osteoid or subperiosteal sarcoma, states that these growths are especially encountered in the knee ends of the femur and tibia, and Butlin says that central sarcomas attack the same bones as the subperiosteal variety, so that they may be considered in the same manner and order. He asserts that "the long bones of the lower extremity are much more liable to malignant disease than the long bones of the upper extremity, the femur and tibia are the most frequently affected of all the long bones, the tibia perhaps rather more often than the femur, while the fibula is very rarely attacked. The humerus comes next to the tibia and femur in liability to the disease, the radius is not often attacked, and the ulna so seldom that it is difficult to collect any number of cases of ulnar sarcoma. Treves gives his opinion to the effect that the bones of the lower extremities are more frequently attacked than those of the upper, probably on account of their greater liability to injury, and the lower end of the femur and upper end of the tibia are more commonly affected than the other extremities of these same bones probably for the same reason, that the knees are more often exposed to trivial injuries than any other parts of the lower limbs. In osteosarcoma it has been noteworthy that the part of the bone affected is the epiphyseal end. Senn remarks that "sarcoma is found most frequently in that part of the bone where the circulation is most active,—that is, in the epiphyseal extremities of the long bones, and in the inner layer of the periosteum, the cambium." Gross also states that sarcoma of the long bones evince a great predilection for the articular extremities, and the majority develop in the spongy tissues of the epiphysis. In periosteal round-celled sarcomas, however, the same writer says the shafts of the long bones are much more frequently affected than the epiphyses.

In endotheliomata a similar predisposition is apparent, the site of the neoplasm being for the most part near the articular or epiphyseal extremity of the bone, where the vascular distri-

bution is greatest    The exact position as given by the various authors is as follows

Lucke	Humerus	Middle
Billroth	Tibia	Lower half
Schweininger	Humerus	Not given
V Lukovicz	Femur	Upper third
Kolaczek	Tibia	Upper part
Hildebrandt	Humerus	Lower end (near elbow-joint)
Driessen	Ulna	Upper end
Gaymard	Femur	Upper end
Ritter	Tibia	Lower end
Berger	Humerus	Upper portion
Crile	Humerus	Middle third
Crile	Femur	Lower third

The exact point of origin of the endotheliomatous tumors, not unlike osteosarcoma, is either from the medullary canal of long bones or the spongy tissues of flat bones, *i e*, central, or on the other hand from the periosteum, *i e*, subperiosteal. The great majority of cases are of the central variety. Such are the cases of Lucke, Billroth, Engelmann, Schweining, Driessen, Volkmann, Berger, etc. Among the subperiosteal endotheliomata is to be noted especially the case of Jaffé. In Markwald's case, tumors of both the central and subperiosteal variety were found.

*Symptoms Pain*—The symptoms of osteo-endotheliomata are identical with those of all osteosarcomata. Pain in these neoplasms is neither constant nor present in all cases, its presence being dependent in most instances upon pressure on or on the involvement of a nervous trunk. It is for this reason variable in character, its onset, duration, degree, etc. Tanaka, in writing of the clinical symptoms of endotheliomata in general, states that these tumors usually pursue a painless course. In central endotheliomata there is probably more often pain than in the subperiosteal variety, it commonly preceding the appearance of the tumor for several weeks or months.

*Tumor Formation*—The appearance of swelling or tumor formation makes itself evident at different stages of the disease. In central endotheliomata no enlargement or growth may be perceptible to either inspection or palpation, a spontaneous fracture from the erosion of bone giving the first indication of the probability of an existing neoplasm. In other cases, however,

an enlargement of the affected bone becomes apparent, and especially so in the subperiosteal variety, in which the tumor formation forms the first reliable clinical symptoms. When first appearing, the tumor is of small size, and in the great majority of cases is reported on as not having increased rapidly in size, usually only attaining the size of a child's head. Pupovac states that a slow growth is characteristic of endotheliomata. In certain cases, as in those of Lukovicz and Volkmann, the growths, after having been in a state of quiescence for some time, suddenly acquired a tendency to proliferate rapidly. In Lucke's case a rapid increase in the rate of growth occurred after the bone had spontaneously fractured.

*Capsule* — The demarcation between the tumor and surrounding tissues is in most instances established by a capsule. In the central growths of osteosarcoma, this capsule is either bony, membranous, or partly bony and partly membranous, while in the subperiosteal tumors it is always membranous when present. In endotheliomata of bone, the capsule, when mentioned, is usually stated to have been of a fibrous nature. Hildebrandt, however, refers to a bony capsule in bone endotheliomata, which he states to be formed from the periosteum. The statement that such a bony capsule is a new formation is somewhat problematical, as in osteosarcoma it is known to be a resulting derivative from the expansion of the cortical portion of the bone. This expansion of bone is caused by the invasion of the malignant growth, the tumor being thereby encased in a bony shell. The membranous capsule is derived from the periosteum, and probably to some extent, also, forms other connective tissues in the near vicinity of the bone and atrophied portions of muscles. Its thickness at times characterizes its most distinct attribute, which tends to hold the growth of the tumor in abeyance. Capsule formation in all endotheliomatous tumors has been frequently observed. Kolaczek, in a collection of 78 cases of endotheliomata affecting all the various tissues, states that in over one-half of these a capsule was present. Nasse, in an enumeration of 31 cases of endotheliomatous tumors of the salivary glands, asserts that in but one case was the capsule absent. Volkmann also gives the capsule a prominent position in the description of these neoplasms. The capsulation of these tumors is clinically of great importance, as it limits the growth of the new formation, and

prevents early metastasis and general dissemination. When this investing membrane ruptures, the tumor may suddenly acquire rapid proliferative properties, the degree of its malignancy is thereby accordingly increased.

In their configuration these tumors correspond closely with the osteosarcomata in general, their contour being in part dependent on their situation and point of origin. In central osteosarcoma, whether situated on the epiphysis or diaphysis, a spherical or globular shape is usually found. In the subperiosteal variety, when situated on the shaft, a spindle-shaped enlargement has been more often noted when at or near the articular extremity, somewhat pyriform swelling. This variety, moreover, never enlarges the bone equally in all directions, but merely produces a swelling on one aspect, and little or none on the opposite side. In central sarcoma, the tumor formation may also affect only one side of the bone, but in other instances, the cortex of the bone becomes expanded from the pressure of the growth of the neoplasm, and it bulges out on all sides. Endotheliomata of bone conform in these characteristics with osteosarcoma. Similarly, also, in the character of their surface, which is usually smooth and even, although in certain instances it has been observed to have been lobed nodular or tuberos, as in the case described by Hildebrandt. At times all configuration is lost, and there results from the extensive infiltration of the contiguous tissue, as in one of our cases, a diffuse growth and somewhat general enlargement of the part.

*Pulsation*—The occasional occurrence of pulsation in these tumors has in several instances, as in the case of Kocher, given rise to the erroneous diagnosis of aneurism. In this case not only was pulsation present, but also other symptoms pathognomonic of aneurism, viz, a systolic bruit compressible of the tumor by both direct pressure, and especially upon compression of the carotid artery of that side. Ligation of the artery, moreover, caused a total disappearance of both the pulsation and systolic bruit, which persisted for twelve days, when a faint pulsation but no murmur again reappeared. In one of our own, and in other cases reported by Lucke, Jaffé, and Billroth, both a pulsation and systolic bruit were present. In other instances, however, while a pulsation is described, no mention is made of the systolic bruit or other murmurs. The great vascularity of these tumors in

which pulsation was noted probably explains this occurrence (Cases of Kocher, Jaffé, Berger, etc.) In others, as in the case of Ritter, blood spaces which communicated with each other are especially remarked upon

*Spontaneous Fracture*—Spontaneous fracture was noted in seven cases out of thirteen, in which the long bones of the appendicular skeleton were affected. Three times it occurred in the humerus and three times in the femur, and in one case, that of Berger, both the humerus and femur spontaneously fractured, the latter being the seat of metastasis. As already stated, spontaneous fracture at times gives the first indication of the existing neoplasm. It may occur without any premonitory symptoms, being the result of an erosion or pressure atrophy of the bone caused by the growth of the tumor. Theoretically, spontaneous fracture should occur only in central endotheliomata, the subperiosteal variety of these tumors, for the reason that they extend in an outward direction, and do not tend to invade the bone, and seldom, if ever, give rise to its occurrence.

*Metastasis*—While Gross found that in osteosarcoma, metastasis occurred in 40.06 per cent, we note that in bone endotheliomata it is reported on in 63.64 per cent of the cases. The organs which are most liable to metastasis are alike in all sarcomata, the lungs and the various bones of the skeleton. The spleen, liver, and lymphatic glands are more rarely affected. The greatest predilection for metastasis from endotheliomata of bone seems to be the bony skeleton, thus, in fourteen cases in which metastasis occurred, the bones were affected nine times, the lungs four times, the liver three times, and the lymphatic glands twice, and the spleen but once.

*Diagnosis*—The diagnosis of osteo-endotheliomata cannot during life, from a clinical stand-point, be definitely established, as these neoplasms, as has already been repeatedly mentioned, conform in their essential characteristics with the osteosarcomata. Hildebrandt says that these tumors show no clinical differences. Symptoms entirely pathognomonic of bone endotheliomata which would serve for a differential diagnosis between the two do not exist. Among the differential characteristics may be mentioned the age at which these respective tumors are liable to appear. In patients of over forty years, it is recalled, endotheliomatous bone formations are more common in those whose age is below this



period, while the reverse is the more common occurrence of endotheliomata, and the fact that numerically cases of osteosarcoma are more often found, however, counterbalances any value which may be attached to this distinction. The other symptoms, such as pain, their situation, rate of growth, nature, and configuration of the tumor, metastasis and cachexia either singly or collectively, do not clinically serve to more clearly elucidate the nature of the given growth, whether it be a sarcoma or endothelioma. From other affections with which they may be confounded, the differential diagnosis is the same as for osteosarcoma. These are carcinoma, aneurism, if pulsation and its other pathognomonic symptoms be present, other bony tumors and the various inflammatory diseases of bone, periostitis, osteomyelitis, tuberculosis, and syphilis. The diagnosis from carcinoma, even with a microscopical examination, is at times difficult, much the more so from the clinical stand-point. Aneurism, also, may in rare instances so resemble these malignant tumors that it is impossible to differentiate them. Hildebrandt and Klebs each mention a case which, from its gross appearance, was stated to be an osteo-aneurism, and microscopically shown to be an osteosarcoma.

Concerning the prognosis of bone endotheliomata, but little can be said, as the experience with the same has as yet been too scant. The prognosis may be stated as favorable in all cases in which an operative treatment can be safely instituted. In tumors of the vertebral column and in those of the base of the cranium, where incision cannot be made, the fatal course of the disease can avowedly not be arrested. Metastasis also renders the prognosis unfavorable. Tanaka says, regarding the prognosis, that it is only favorable in those cases in which it is possible to eradicate all of the diseased tissues. When a diffuse infiltration is present, the chances for a complete extirpation of the disease and an ultimate recovery are markedly increased. In such cases not only the parent growth has to be removed, but also all the metastatic processes which radiate from it and are found in the surrounding tissues.

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# MALPOSITION OF THE APPENDIX AS A CAUSE OF FUNCTIONAL DISTURBANCES OF THE INTESTINE.<sup>1</sup>

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A NUMBER of patients upon whom I have operated for supposed appendicitis have been entirely relieved of their symptoms, yet upon examination no inflammatory conditions in the appendix have been found

All these patients presented a similar syndrome of symptoms which resembled those occurring in the course of a mild chronic appendicitis, but were not sufficiently characteristic to warrant a definite diagnosis of that disease

The following cases sufficiently illustrate the symptoms and the anatomical conditions

CASE I—A A, aged forty years, female, has had attacks of pain in the right lower quadrant of the abdomen for four years. The pain has never been severe, but has been rather an extreme discomfort. After a maximum of discomfort for two or three days there has been gradual improvement. There has never been marked tenderness. Occasionally there has been nausea with the pain, but nausea has not been a feature. There has not been a temperature worthy of note in any attack.

The attacks have been accompanied with constipation and intestinal gas. After the bowels act freely the pain diminishes. Between the attacks there has often been discomfort, with rumbling of gas. The patient is a very active, non-imaginative woman engaged in arduous charitable work. The attacks, while interfering with her work, have rarely confined her to her bed.

P E, well-nourished woman. The examination of the abdomen revealed a slightly movable right kidney. During the

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<sup>1</sup> Read before the New York Surgical Society, April 12, 1905

attack there was some distention of the caput coli with gas and slight tenderness at the region of the appendix, but no palpable mass

*Operation*, September 10, 1901 —The appendix was of the third type (Treves), two and one-half inches long The meso-appendix was very short, suspending the appendix and with it the cæcum well up under the ileocolic junction, at its attachment to the appendix it caused a sharp bend in that organ At the point of bending the lumen of the appendix was somewhat narrowed There were no signs of recent or old inflammation On dividing the meso-appendix the cæcum straightened out away from the ileocolic junction The appendix was removed

The patient has been entirely free of her attacks since the operation

CASE II —W S, forty-seven years of age, male Active business man, somewhat neurasthenic Attacks for two years at intervals of one to two months

The attacks have been characterized by gas pains in the right lower quadrant of the abdomen, with little or no tenderness Diarrhœa has been present in several attacks Constipation has never been a feature The patient has found that relief has at once followed a free catharsis with castor oil

The patient has himself made a diagnosis of appendicitis and demands relief

The physical examination was negative except for a very slight tenderness in the appendiceal region during the attacks

Operation was decided upon after observing several attacks, and the following conditions were found The appendix was implanted at the axial end of the cæcum (second type of Treves), it was four inches long, its extremity was slightly bulbous, there was no stricture or sign of inflammation The meso-appendix was short and suspended the end of the cæcum, as in the first case, up under the ileocolic junction Appendectomy allowed the cæcum to regain its normal relation

The operation has been followed by complete relief

A number of the cases observed have resembled the ones just reported in the relations of the appendix and cæcum to the ileocolic junction, namely, being drawn up under it by a short meso-appendix

Another relation of the appendix may be present as was found in the following case

CASE III —The patient, E W, a nurse, thirty-six years old, had suffered for two years or more with constantly recurring pains in the right lower quadrant, but not of sufficient violence to keep her off duty. There had been no signs typical of inflammation. Operation revealed an appendix four inches in length of the third type of implantation and in the retrocæcal position, the end of the cæcum being rolled up under itself.

Operation in this case was also followed by complete relief.

The above cases are fair examples of others I have operated upon. In looking over the notes of ten of these, two were found in which there were well marked evidences of enteroptosis and two in which the right kidney was distinctly movable.

In most of the cases traction was exerted on the cæcum through the appendix by a short meso-appendix, in a few the cæcum seemed to be suspended by the appendix being adherent behind the colon. Evidences of inflammation of the appendix were either wholly absent or so trivial as to hardly be sufficient to explain the symptoms.

An explanation of this anatomical condition is found in the development of this part of the alimentary tract. It is well known that the cæcum in late intra-uterine life descends from a position immediately below the liver to its normal one in the right iliac fossa. The descent is due rather to an increase in length of the descending colon than to a dropping of the colon. As the length of the colon increases, its vessels must also increase proportionately or a folding of the gut will occur.

In the class of cases under discussion, this disparity of growth occurs, and a folding of the gut results at the junction of the cæcum with the appendix from an inadequate growth of the vessels in the mesenterium. As these vessels normally pass behind the ileocolic junction, the appendix is held up behind that point and through it the end of the cæcum. In many instances a sharp kink of the appendix occurs at the point where its main vessel reaches it.

In some of the cases it appeared as if a constriction of the ileum might readily occur by an overdilated cæcum and ascending colon drawing it down over the band produced by the short meso-appendix

With such a mechanical relation of these structures, it would seem that the symptoms complained of by these patients could be caused in the following ways, namely, by the tugging on the appendix and meso-appendix produced by an overdilated or overloaded cæcum, by a partial obstruction produced either in the ileum or the colon by their bending over the fixed appendix, or possibly by interference with the circulation of the cæcum and ascending colon

When we analyze the symptoms, we see that they are an evidence of functional disturbances rather than inflammatory conditions. Fever and marked tenderness are absent. The pain is more a sense of discomfort, and lacks the violent colicky character accompanying inflammation of the appendix. The exacerbations of the pain are generally accompanied by constipation or evidences of intestinal fermentation, such as diarrhoea and flatus. The discomfort between the exacerbations is more or less continuous. Purgation in nearly all instances was followed by at least temporary relief.

With this evidence, it would seem fair to ascribe the symptoms exhibited by these patients to the relation of the appendix and its mesentery to the cæcum rather than to an inflammation of the appendix itself, even if the latter condition were found.

I am well aware of the danger of advancing a theory of this kind, since it might well be used for extending the field of meddlesome surgery. For this reason I have hesitated, and, although I have had the theory in mind for four or five years, I have abstained from bringing it forward until the repeated observation of this condition has forced me to believe that it is more than theory.

While most of the patients were women and neurasthenia might be a factor in the production of the symptoms, in the greater number it could be eliminated.

This relation may also explain the appendiceal pain observed in some cases of movable kidney in which appendectomy gives relief. In enteroptosis a short meso-appendix may readily cause tugging upon the appendix and cæcum. Finally, the constant tug on the appendix and cæcum is undoubtedly a cause of true appendicitis.

# THE RADICAL TREATMENT OF CANCER OF THE RECTUM <sup>1</sup>

WITH PARTICULAR REFERENCE TO THE VALUE OF INGUINAL COLOSTOMY

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To the surgeon of to-day the study of carcinoma wherever found is one of peculiar interest and importance. With our present knowledge, the only treatment which offers relief from this disease is the operative, and with improved technique the field for operative interference is constantly widening, while the results are becoming more satisfactory. These facts, and the knowledge that cancer is becoming more and more frequent, are the incentives which tempt surgeons to attack the growth wherever and whenever it appears within reach of the knife.

Cancer of the breast, occurring as it does in an external part and in an organ which can be removed *in toto* without endangering life or causing a serious functional defect, affords the most promising results, and, except to bring all such cases to an earlier operation, it seems that no further advance can be made in the recognized treatment. Unfortunately, cancer of the rectum presents quite another set of conditions because of its hidden position and the anatomical and functional difficulties attending its complete eradication. However, the same principles are here in force, and it is to formulate the application of these principles that the records of the cases here presented have been collected and studied.

The cases at our disposal for this purpose are forty-six in number, all of which have been operated for the radical cure of cancer of the rectum, and in addition two cases of inguinal

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<sup>1</sup> Read before the New York Surgical Society, March 22, 1905



colostomy (one for cancer and one for syphilis of the rectum) in whom no rectal excision was done Forty-four of the cases were operated on by various surgeons of New York City, seventeen in all, to whom I am indebted for the privilege of using their records,\* and six, including the two colostomy patients, came under the care of the writer during the past year

The study of the cases has been carried on mainly from the stand-point of determining results, and, if possible, of ascertaining the line of treatment which promises the largest per cent of cures with the least sacrifice of functional control

With this in view, the following two principles of the operative treatment of cancer have been kept in mind as essential to a cure First, that cancer can be cured by operation only when it is attacked in an early stage Second, that cancer can be cured by operation only when the growth itself is removed in its entirety, and with it all the immediately surrounding cancer-bearing tissue and the lymphatic glands draining these regions

The study of the cases with reference to an early diagnosis is most instructive, and gives rise to hope for marked improvement in the matter of an earlier attack against the disease as it occurs in the rectum The average period which elapsed from the appearance of symptoms which might have led to a diagnosis to the time when a diagnosis was actually made was about nine months, the shortest time being one week and the longest two years, this period occurring five times The reasons for this tardiness in discovering the true condition are several In the first place, the growth usually occurs sufficiently high in the bowel not to give any external manifestation, or, in its early stage, to interfere with sphincteric action

Further, the early symptoms of rectal cancer are in no way characteristic and do not differ from those of many benign

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\* I desire here to express my thanks to Drs Bolton, Briddon, Brown, Eliot, Johnson, Adrian Lambert, McCosh, McWilliams, Frank Markoe, Murray, Peck, Stimson, Tilton, Weir, and Woolsey Also to Dr Arthur R. Green, who collected the histories and followed the cases

lesions of this organ. In nearly every case the first symptoms were pain and bleeding from the rectum. Nor do constitutional manifestations appear early enough to be of value in forming a diagnosis at the proper time. An appreciable cachexia was present in only one-third of the cases even at the time of operation. Finally, a sentiment of modesty oftentimes deters the patient from fully reciting the symptoms present or from having the proper examination made. These all tend to delay, and not infrequently a patient is treated during a period of months for hæmorrhoids, fissure, or fistula, when a thorough examination would have revealed the true condition to be one of cancer. Several of the cases here reported gave such a history when finally they came under the care of the operating surgeon.

One case, No. 46 of the series, will illustrate this fact. A woman, aged twenty-six years, passed through a pregnancy, and was finally delivered at one of our hospitals. The delivery caused a laceration of the vagina and perineum through into the rectum for a distance of three inches. A month later she came under the care of the writer at the Lincoln Hospital to have this condition remedied. An examination showed the patient to be in an extremely cachectic condition and markedly septic. The perineal and rectal tears were foully infected, and a condition of complete incontinence existed, the region being filled with foul, purulent, fæcal matter. The parts were so excessively tender that no examination could be tolerated, and, after nearly a month's fruitless attempt to get them in a cleaner condition by antiseptic irrigations, an inguinal colostomy was done for this purpose. Examination showed that an encircling cancer of the rectum involving the vaginal wall was the true condition, and that this accounted for the pain and the sepsis. She had been under treatment nearly two years for some rectal trouble, and it must have been in existence when the child was born, yet it remained undiscovered.

Such cases emphasize the fact that the possibility of a rectal cancer must take a more prominent place in the minds of the profession at large, and that no fancied security against

the disease must be indulged in without a thorough examination Mayo has formulated the principle that pyloric cancer to be successfully treated must be attacked before a positive diagnosis can be made in any less radical way than by an exploratory laparotomy Accordingly, he advocates this procedure when one has good ground for *suspecting* the disease This may be rather radical, but, severe as it is, the writer believes it would, if put into execution, lessen the suffering and mortality from cancer of the pylorus An exhaustive examination of the rectum entails no such severity, and in the majority of cases can be performed in the office without an anæsthetic, and with no more inconvenience to the patient than is entailed in the giving of an enema

It seems fair to say, therefore, that every patient who presents himself suffering from any symptom of lower bowel trouble is entitled to a thorough rectal examination, first digital, and, if this is negative, instrumental, with one of the proctoscopes now in general use Only in this way can the diagnosis be made at a period when the hope of cure can be greatest Youth is no guarantee against the disease, as five cases were less than thirty years old, the youngest being only twenty-three, and general statistics emphasize this point

The accomplishment of the second principle in the bettering of results, namely, the complete eradication of the disease and the zone of danger surrounding it with their lymphatics, presents a far more difficult problem than the one just concluded

The obstacles to this end are two First, the anatomical and functional conditions of the rectum are such that the operative procedure itself is a dangerous one, and particularly liable to be followed by sepsis Second, the destruction of the function of the rectum and anus to the degree needed for complete eradication of cancer is a matter of the utmost seriousness to the patient The two obstacles are so closely related that the overcoming of one is apt to increase the other, and hence, in considering the best means to combat one, we must have constantly in mind the second

In the present series of cases the operative mortality was 26 per cent, that is, 12 cases died as the direct result of the operation. An analysis of the causes of death shows that 7 cases, or 58½ per cent, died of sepsis in one form or another. Three cases died from the shock of the operation, and in two the cause was not given. Hupp, in the *Medical News*, September 28, 1901, with an analysis of 881 cases, quoting Kronlein, gives the mortality as 19.4 per cent. In the same article, with 171 cases analyzed for the cause of death, 83 just under one-half died from septic infection. Other observers put the proportion of death due to sepsis in some form at even a higher per cent, 60 to 70.

Severe as these percentages show the operation to be, we must acknowledge an even greater death-rate with our present technique, if an operative procedure is carried out which is radical enough to promise better permanent results, statistics now giving only 15 to 20 per cent of cures. Our first consideration is to find a means then of lowering this mortality without sacrificing thoroughness. Earlier operation will do much in this direction, but a more important factor will be the elimination of sepsis. The cause of the infection is, of course, in the majority of cases, the contamination of the wound with faecal matter either during the operation or immediately subsequent to it. This can in a great measure be avoided, and hence the mortality should be decreased by nearly, if not quite, one-half. The more radical operation needed to insure the best hope of a permanent cure would, on the other hand, increase to a certain extent the death-rate from shock and allied conditions, but this would be slight as compared to the gain from the elimination of faecal infection.

How can this best be accomplished? The writer is strongly of the opinion that it can only be satisfactorily done by a complete deflection of the faecal current from the normal channel, that is, by the formation of a complete inguinal colostomy. Much may be gained by a thorough attention to getting the bowels in good condition and the rectum cleansed from its purulent discharge by a week's or more treatment to this

end Regulation of the diet so as to leave the least residue, mild catharsis so as to empty the bowels in spite of the constriction of the growth, and rectal irrigation twice daily with hydrogen peroxide, potassium permanganate or creolin followed by saline solution, are the means best suited to this purpose At best, however, these only do away with a certain amount of the infection during the operation itself, while in badly constricted cases they accomplish nothing, and do not in any case provide against the subsequent infection from the passage of *fæces* over a fresh wound It may be urged that in those cases where only a resection of a piece of the bowel is needed and an end-to-end anastomosis is done, the latter condition will not obtain because the anastomosis will be firm enough to prevent any leakage into the wound Unfortunately, this is not true, because the union is not firm enough for this, and, moreover, this ideal method is applicable to only a very limited number of cases if a thorough eradication is obtained

A frequent objection advanced against performing a preliminary inguinal colostomy is that this operation may interfere with the sufficient drawing down of the gut for the radical removal later to be performed This objection carries no weight if the colostomy is done in such a way as to avoid it, which is a matter of easy accomplishment In short, the preliminary colostomy accomplishes the end to be desired in a perfect manner, and is the only method that can accomplish it Moreover, if indicated, the distal end of the artificial anus may be used for additional cleansing of the bowel during the time between its establishment and the rectal resection Again, valuable information as to the extent of involvement of the rectum and pelvic organs may be obtained by exploration through the colostomy wound Finally, this procedure is in most conditions followed by a marked general improvement of the patient during the convalescence, so that the three weeks which should intervene before the radical operation is done is a cause of gain more than enough to compensate for the loss of time in permitting an advance of the growth

An equally important means of combating the development of sepsis is the exercising of the greatest care in avoiding contamination of the wound from the gut during the operation. The rectal caliber is never surgically clean, no matter what precaution and preparation are followed. This contamination can be accomplished by closing the bowel at the anus, and above and below any section of it by a purse-string suture, and then making the section with the actual cautery. It is difficult to say to just what extent this precaution is taken or neglected, but, judging from published articles and personal communications, it seems that its importance is not sufficiently appreciated.

The value of colostomy for the prevention of sepsis can be more definitely determined. In this series it was performed six times among those cases developing a serious sepsis, and nine times when no sepsis supervened. In nearly all of the fifteen cases, however, the colostomy was only a lateral anastomosis, and hence the requisite for protection of the wound, *i e*, complete deflection of the fæces, did not obtain. Severe infection occurred in only one of the five cases when the colostomy was complete. Marked fouling of the wound was present with subsequent infection, and a varying grade of sepsis in nearly every case where the colostomy was not used.

In one case of the series, No 41, it was not performed as a preliminary, but had to be done during the radical operation, to avoid the certain later contamination of the wound with fæces because of inability to bring the gut flush with the sacral wound. In another, No 45, where the ideal operation was performed, that is, resection of a segment with end-to-end anastomosis of the bowel, colostomy had to be done eight days later because the fæces caused breaking down of the union, and a sepsis supervened which could be controlled in no other way. Both these cases made good ultimate recoveries, and the latter was shown as an example of functional control in an inguinal colostomy. It therefore seems established that, without a complete colostomy, infection of the posterior wound and a sepsis often fatal is the rule, while with it

these conditions do not obtain. Unfortunately, the forming of a complete colostomy is not entirely devoid of danger, a number of fatal cases being found in the literature, and the writer having lost two in the past. These last, however, were due to errors in technique, as most of them have been, and the mortality ought to be found to be very low with improved methods.

There still remains to be considered the means by which a greater number of cures may be obtained in those surviving the operation with the best possible retention of faecal control.

Of the 46 cases here reported, 44 were traced to their death or to the present time. A study of these shows a probable cure of about 16 per cent, counting freedom of return for three years as a cure. This conforms very closely to the statistics of all observers based on thousands of cases. The showing is not satisfactory, and we are justified in advocating new methods to improve it.

Our knowledge of cancer in general leaves only one means open for the obtaining of the best results as regards non-recurrence, namely, an operation which removes all cancer tissue, and with it all tissue which is liable to later cancer infection. The writer believes that this can be accomplished, except in the rarest instances, only by a removal of the rectum from well above the growth to and including the anal orifice, along with all lymphatic glands draining this area. In other words, the ideal operation, that is, preserving functional sphincters, is possible only in very rare cases.

The reasons for this belief are based upon the following facts:

First. In the majority of cases the growth is so situated that its lower border encroaches closely on the sphincters, hence it cannot be removed completely and leave behind a sufficient distal segment to which to attach the proximal end with the hope of a sphincteric control. In every case here reported the growth was easily within the reach of the finger, and the great majority were recorded as about two inches from the anus.

In other words, they were so situated that saving the anal segment was entirely out of the question, and it was unhesitatingly sacrificed. Statistics from various sources show that in more than half the cases a safe zone distal to the growth does not exist.

Second Gerota has shown that the lymphatics draining the rectum are divided into four groups: 1 The anal skin, 2 The intermediate anal, 3 The columnar anal, 4 The group draining the rectum proper. Of these, group 1, that is the anal skin, drains both outward towards the thigh and inguinal glands and upward into group 3. The other three groups all drain upward, following in general the course of the superior hæmorrhoidal artery branches. The glands and vessels which are placed at first laterally thus become more and more posterior until they finally all drain into the glands occupying the sacral hollow nearly as high as the promontory between the converging leaves of the peritoneum, which is here forming the mesosigmoidea. It will be noted that even the anal margin has an anastomotic circulation of lymphatic vessels with this superiorly situated group, and so in cancer low down the sacral glands are a source of recurrence and should be removed.

This extensive distribution of lymphatics (Funke found that two-thirds of operative cases showed glandular involvement) necessitates a correspondingly extensive operation, and the intimate association of the various groups makes it imperative to remove them all, except the inguinal glands when these show no involvement. This can be accomplished satisfactorily only when no attempt to save the sphincters is made, and an amputation is done.

Third The desire to save the lower segment, and thus keep the sphincter intact, often tempts the surgeon to leave more of the gut than his better judgment dictates, just as the desire to avoid the scar of engrafted skin may lead to a too close section in the case of mammary cancer. A frank abandonment of this hope except in rare cases will avoid falling into this error.

Fourth It is commonly accepted that a constantly re-



curring irritation of a part which is liable to cancer development is an etiological factor in producing the neoplasm. An end-to-end anastomosis must inevitably produce some scar tissue with a certain amount of constriction as its sequela, and this in the tissue of an individual who has a cancer tendency and in a part which is subject to constantly recurring irritation. Statistics show that in most cases the recurrence takes place locally. In this series the per cent is 100, every case that showed a return having the growth in or about the rectum.

It would therefore seem that the attempt to retain the anal portion even in high situated cancers is open to many objections, and that the results, so far as obtaining a cure is concerned, would be improved by sacrificing it. This opinion will probably be accepted without debate, but the question immediately arises as to whether the functional mutilation thus entailed justifies the end. In answering this, the first point to be considered is a comparison of this functional mutilation with that resulting from a less radical operation.

It has already been pointed out that considerably more than 50 per cent of all rectal cancers are so situated that a saving of the sphincters is out of the question. In the remaining cases these muscles might possibly be saved as anatomical structures, but this does not mean functional integrity. The high situated cancers in which the sphincters are in the safe zone require a correspondingly high resection and complete removal of sacral glands and interstitial tissues. This means an extensive deep dissection which will surely to a greater or less extent damage the innervation of these muscles, and to this same extent impair faecal continence. It is difficult to measure the degree of functional control present under such circumstances, but it is certain that often there is little. In this series not more than one or two cases so operated got a really good control of the bowels. Hence the chief objection (namely, the impairment of function) to the extirpation of the rectum from well above the growth to the skin becomes invalid, because this impairment is no greater than with a

less radical procedure, and the method has the great advantage of promising the surest immunity from recurrence

The final problem to be solved is what substitute shall be made for the sphincters thus destroyed. Two accepted procedures are in use,—one, the sacral or perineal method, and the other, the inguinal method. The latter when properly performed seems to the writer to hold out the promise of giving the greatest functional control, and to this is added the advantage, already shown, of having the anus so situated, as a preliminary to the radical operation, in reducing the mortality of the latter.

A great advance has been made in recent years in so forming the colostomy that some satisfactory substitute for a sphincter shall result, and there are many cases on record in which patients with this condition have lived in comfort without interfering with their usual occupations.

It is not necessary to enter into a complete discussion of the various methods advocated. Suffice it to say that some form of intermuscular operation seems to offer the most favorable results.

Earlier diagnosis and a complete eradication of the growth, done after the following method, promises, then, the most satisfactory results both as regards permanency of cure and functional integrity.

An inguinal colostomy is first performed by drawing the sigmoid through an intermuscular incision just external to the left rectus muscle and dividing it between two ligatures. The point of division should be as low in the bowel as possible, thus leaving a large sigmoid pouch as a reservoir above the new anus. The distal end is closed and dropped into the pelvic cavity, or, if indicated, may be fastened in the lower angle of the wound for the purpose of through-and-through irrigation. In this case the lower segment must be left sufficiently long not to interfere with the radical excision to be done later.

An incision is then made in the linea alba at the same level as the intermuscular incision, or, better, slightly above it,

and the anterior sheath of the rectus between the two incisions raised up from the muscle. The proximal end of the gut with its mesentery is then drawn under this strong sheath over the rectus muscle, and fastened into the skin and fascia wound in the middle line. This opening must not be too small, because it shows a tendency to contract and form a stricture. The gut is tacked to the peritoneum where it emerges from the peritoneal cavity, and the skin and fascia wound is here closed. A protective dressing can be so applied as to insure almost complete primary union. It is well to insert a small catheter into the proximal gut for a distance of six or eight inches to facilitate the passage of gas during the first days following operation.

Three weeks later the radical amputation is done. The patient is put in the exaggerated knee-chest position, which controls to a remarkable degree the venous oozing, and an incision made from the third sacral vertebra downward to and around the anus. The anus is then tied with a purse-string suture, and the eradication of the growth and all the glands begun. The coccyx and one or two sacral vertebræ are resected, and the presacral tissues as high up as the second vertebra are pushed away from the bone, saving only the sacral nerves. This includes all the lymphatic glands and vessels which are apt to be infected.

Ligation of the superior hæmorrhoidal artery is next done, and then the gut is free posteriorly. It is now freed laterally and the peritoneum opened when reached. This permits the drawing down of the rectum even up to the blind end, or, if the end was fastened in the colostomy wound, well up towards that point. In the former case the whole lower segment will be removed, in the latter the gut is divided between two purse-string sutures with the actual cautery and the upper end closed. This technique obviates the leaving of a piece of bowel closed at both ends, a procedure which has been shown to be dangerous.

Beginning at the upper division, the gut to be removed is separated from its anterior and remaining lateral attachment

from above downward, and finally removed in one piece with all lymphatics and glands attached to it. The peritoneum is sutured, the closed end of gut, if present, being fastened in the opening, the wound closed, and a small drain put in it.

This method can be carried out with no faecal contamination to the wound, and, as Tuttle has pointed out, the starting above and working downward has the advantage of avoiding cutting through the infected lymphatic tissues. This advantage is analogous to the one of beginning the removal of breast cancer at the most distal lymphatic glands and working towards the growth in the mammary gland.

The detailed histories of the cases follow and the percentage statistics are tabulated.

CASE 1—I S, aged thirty-four years, female, white. New York Hospital, Dr Bolton. Adenocarcinoma.

*Family History*—Negative for neoplasm.

*History*—Began four months previous to operation with painful defecation and blood in stools. Experienced sharp pain in lower part of rectum. Marked loss of strength and fifteen pounds weight during past six months.

*Physical Examination*—Rather anæmic, well-nourished woman. Local. Nearly impassable stricture of rectum three and one-half inches from anal opening, due to a mass palpable through vagina.

*Operation*—February 9, 1904. Preliminary colostomy. Kraske-Sims position. Rectal irrigation, coccyx and small piece of sacrum removed, four inches of gut excised, end-to-end suture of gut. Hæmorrhage slight.

*Postoperative*—Large amount of faecal discharge, February 12 to March 11. February 18, wound partly broken down.

Discharged May 14. Gained twenty pounds. Inguinal colostomy wound still open.

Present condition. February 16, 1905, has "pretty good" control over defecation (by way of artificial anus). Anal fistula does not close. Considerable gain in weight.

CASE 2—M K, aged forty-six years, female, white, housewife. Presbyterian Hospital, Dr McCosh. Malignant adenoma.

*Family History*—Negative for neoplasm

*History*—Nine months previous to operation patient noticed her stools were streaked with blood, which condition prevailed at intervals Diarrhœa followed and became progressively more marked,—ten to twelve movements daily Size of fæces gradually became smaller Considerable rectal tenesmus Loss of strength Weight normal

*Operation*, January 20, 1898 —Perineal incision Coccyx removed Distal ten inches of gut excised and proximal end sutured to a remaining one and one-half inches of gut at anus Operation followed by rectal obstruction Dilatation Discharged improved, June 5, 1898 Died later

CASE 3—F L, aged twenty-eight years, male, white Presbyterian Hospital, Dr Brown Adenocarcinoma (July 25, 1899)

*Family History*—Negative for neoplasm

*History*—Began four years previous to operation with pain in rectum and blood in the stools Was operated on at that time for tumor of rectum Passages were free Since that time has been well until three months previous to present operation, when the pain returned Pain is not severe, but annoying and remains after defecation Movements are formed

*Operation* (second) —July 25, 1899 Incision in median line of sacrum in old scar Dense connective tissue found surrounding the rectum, divided, gut dissected out, drawn down, mass excised, end-to-end suture of gut

Discharged cured, August 27, 1899 Died shortly after leaving the hospital

CASE 4—J M, aged fifty-six, male, white, tailor Presbyterian Hospital, Dr McCosh Carcinoma

*Family History*—Negative

*History*—Nine months previous to operation noticed blood in stools, which continued, fæces progressively grew smaller, to size of lead-pencil Moderate pain Six to eight stools daily

*Physical Examination*—Local Hard, ragged mass on anterior rectal wall, one and one-half inches from sphincter

*Operation*—January 10, 1898 Perineal Schleich No 2 anæsthesia Coccyx removed Gland in left side of pelvis enlarged, removed Hæmorrhage considerable, controlled by

sponges Distal end of gut excised, perineal end sutured to skin  
Silk sutures Died, January 13, 1898

CASE 5—M W, aged twenty-three years, male, white  
New York Hospital, Dr Hartley Gelatinous carcinoma

*Family History*—Negative for neoplasm

*History*—Bowels always regular and rather loose Ten years ago was kicked in perineum, and thinks he noticed traces of blood in stools since then One month previous to operation had tenesmus and constant desire to go to stool, but rarely passed any fæces except after taking cathartic Stools became pencil shaped, streaked with mucus and blood

*Physical Examination*—Tight ring one and one-half inches above anus, apparently similar ring one-half inch higher, considerable bleeding on examination

*Operations*—June 26, 1900 Stricture divided, July 20, 1900 Kraske, November 24, 1900 Incision in line of old scar Cartilaginous constriction extending about gut, divided for two and one-half inches Colostomy

Discharged improved, January 10, 1901 Died about one year later

CASE 6—P W, aged forty-two years, male, white, laborer Bellevue Hospital, Dr Tilton Carcinoma recti

*Family History*—Negative for neoplasm

*History*—Enjoyed good health until five years previous to operation One month previous to operation was so constipated that medicines of all kinds were taken without result

*Physical Examination*—Well nourished Presence of hard nodular growth obstructing lumen of rectum

*Operation*—April 29, 1904 Exaggerated lithotomy position, hips raised Incision, second sacral spine to one-half inch posterior to anus Coccyx and sacrum to fourth foramen removed Mass excised Small sacral glands also Proximal end of gut sutured to anal mucosa Time, one and one-half hours

*Postoperative*—Bladder washings for cystitis

Discharged, June 18, 1904

March 15, 1905, still living and in good health Has some control over bowels, but cannot keep clean through tendency to stricture contraction at anal orifice This required cutting on March 7

CASE 7—J M, aged sixty years, male, white, laborer

Bellevue Hospital, Dr Hartwell Pathological report Carcinoma Inguinal glands not malignant

*Family History*—Negative for neoplasm

*History*—Six months previous to operation patient experienced pain at defecation, knife-like in character, later, this changed to a burning sensation lasting some hours after defecation Four months previous to operation, noticed blood in the stools

*Physical Examination*—Cachectic Hard, somewhat friable growth one and one-half inches above anus Lumen of the gut obliterated Inguinal glands involved

*Operations*—July 9, 1904 Inguinal colostomy by method of using anterior sheath of rectus and the rectus muscle in constructing sphincter August 5, 1904 Knee-chest position Kraske incision second sacral spine to one inch above anus, encircling it Coccyx and two lower sacral vertebræ removed Hæmorrhage, not severe, controlled by clamp and ligature Mass excised between ligatures Six inches of gut and anus removed Proximal end closed Sacral glands and areolar tissue removed Wound closed with drainage

*Postoperative*—August 30 Primary union

Discharged in six weeks

March 22, 1905, has excellent control over inguinal anus, and his general condition is very satisfactory No recurrence

CASE 8—F S, aged sixty years, female, white, housewife Presbyterian Hospital, Dr Eliot Malignant adenoma

*Family History*—Negative for neoplasm

*History*—Began two years previous to operation with painful defecation and straining at stool (Constipated) Pain continued two to three hours after action Stools became small in size and coated with blood Dull ache in sacrum and thighs Eight months previous to operation stools still painful but not more frequent, size of lead-pencil Loss of flesh

*Physical Examination*—Poorly nourished, anæmic, cachectic Internal hæmorrhoids At internal sphincter series of masses surrounding gut

*Operation*—December 12, 1900 Sims's position Kraske operation Glands not noted Hæmorrhage controlled by sponge

*Postoperative*—Mental condition cloudy Wound sloughing December 19 Considerable fæcal discharge December 24

Movements through posterior wound, not through anus    Movements involuntary    January 4    Bedsore of right trochanter  
Sloughing    January 6    Died

CASE 9—A M R, Brooklyn, aged forty-nine years, female, white    New York Hospital, Dr Murray    Carcinoma

*Family History*—Negative for neoplasm

*History*—Habitual constipation, which grew worse with time    One month previous to operation was unable to introduce smallest size nozzle to secure enema    Slight pain one week previous to operation    Loss of strength, not of flesh    No hæmorrhage

*Physical Examination*—General condition good    Local Nodular mass completely surrounding gut in region of sphincter

*Operation*—May 21, 1903    Lithotomy position    Perineal incision encircling the anus    Mass excised    Surrounding tissues involved (possibly some growth left)    End of gut sutured to skin wound

*Postoperative*—Healing by granulation    Complete control of sphincter

Discharged cured (improved), June 22, 1903    Died, January, 1905, after going to hospital for second operation

CASE 10—C M, aged twenty-seven years, female, white, seamstress    Bellevue Hospital, Dr Hartwell    Carcinoma

*Family History*—Negative

*History*—Pain and blood in stools for a few weeks only

*Physical Examination*—Some cachexia    Friable mass reaching around bowel two inches above anus

*Operation*—August 19, 1904    Simple complete colostomy

*Postoperative*—Complained of weakness daily

*Operation*—August 26, 1904    Preliminary irrigations through colostomy wound, August 29    Modified Kraske Knee-chest position    Incision from second sacral spine to one-half inch posterior to anus    Lower part of sacrum (third foramen) and coccyx removed    External sphincter left    Four inches of gut excised, free end sutured to anal portion    Anæsthesia, three and one-quarter hours

*Postoperative*—Hot saline infusion    Catheterization    September 2    Irrational    September 4    Delirious, vomited greenish fluid    September 4    Coma    Died    Cause of death, shock and some sepsis, though no sloughing



CASE 11—A W, aged fifty-eight years, female, white, housewife Presbyterian Hospital, Dr Briddon Malignant adenoma, Dr Thatcher

*Family History*—Negative

*History*—Twelve years previous to operation patient had hæmorrhoids, which lasted for a few months and then disappeared Nine months previous to operation pain was experienced in rectum, posteriorly, during defecation Blood was occasionally noticed and caliber of stools became smaller Loss of weight and appetite

*Physical Examination*—Neoplasm size of chicken's egg, just above internal sphincter

*Operation*—January 6, 1899 Prone position Perineal and sacral incision with division of sacrum at third vertebra Enlarged glands in adipose tissue Rectum divided between clamps and growth excised End-to-end suture of gut Hæmorrhage controlled by clamp and ligature

*Postoperative*—Considerable amount of foul discharge from wound Abdominal distention Involuntary defecation and urination Septic Died January 10, 1899

CASE 12—F N, aged fifty-eight years, male, white New York Hospital, Dr Weir Carcinoma

*Family History*—Negative for neoplasm

*History*—Began one year previous to operation with constipation, straining at stool, frequent passage of blood in stools Two doctors diagnosed bleeding piles and gave medicine No examination made Patient became worse Frequent desire to defecate resulting in no movement Intense pain in back, groin, testicle, and penis One month previous to operation diagnosis of carcinoma was made and patient sent to hospital

*Physical Examination*—Large mass two inches above anus extending entirely around gut

*Operation*—November 22, 1898 Colotomy December 7, 1898 Incision of anus to third sacral foramen Sacrum and coccyx excised Six inches of gut excised, end-to-end suture of sigmoid to remaining two and one-half inches at anal extremity Glands of rectum involved Signs of shock during last twenty-five minutes of operation

*Postoperative*—Considerable fæcal discharge Wound infected December 10, 1898 Cheyne-Stokes breathing December 11 Died

CASE 13—F C N, aged fifty-two years, male, white  
New York Hospital, Dr Weir Carcinoma

*Family History*—Negative for neoplasm

*History*—Noticed blood in stools, June, 1898 Some pain  
Condition lasted seven days January 1, 1899 Had sudden  
onset of cramps in left calf and thigh and pain in back and  
rectum Constant feeling of distention and desire to defecate  
Marked constipation Much straining Urination frequent

*Physical Examination*—Hard nodular bleeding mass encir-  
cling rectum as high as finger can reach and as low down as  
one inch from anus

*Operation*—February 25, 1899 Colostomy March 11,  
1899 Sims's position Incision of anus to coccyx V piece of  
sacrum and coccyx removed Mass excised between ligatures  
of gauze Suspicious adnexa removed Hæmorrhage free, con-  
trolled with great difficulty Patient in collapse Died, March  
12 1899, from shock

CASE 14—I J M, aged thirty-seven years, female, white,  
actress New York Hospital, Drs Markoe and Hartley Adeno-  
carcinoma

*Family History*—Negative for neoplasm

*History*—Pelvic peritonitis nine years previous to operation  
Five years previous to operation suffered from abdominal pain  
Operation, tube and ovary removed, Homœopathic Hospital, Buf-  
falo Similar attack, January, 1901 Operation, St Mark's Hos-  
pital, New York City Abdominal incision, drainage through  
vagina Vaginal sinus persisted June, 1901 Temperature and  
abdominal pain, went to Homœopathic Hospital, Buffalo, treat-  
ment, antiphlogistine poultices to abdomen, result, sinus opened,  
which has persisted Discharge fæcal at times from abdominal  
sinus

*Physical Examination*—Well nourished, moderately anæmic  
Grayish facies (cachexia?) Posterior fornix occupied by indur-  
ated mass

*Operation*—December 11, 1901 Dr Markoe Abdominal  
incision Mass behind uterus dissected out January 22, 1902  
Dr Hartley Abdominal fluid and gelatinous material evacuated  
Complication Bronchopneumonia Died April 21, 1902

CASE 15—T H B, aged thirty-three years, male, white  
New York Hospital, Dr Hartley Carcinoma

*Family History*—Negative for neoplasm

*History*—Began four months previous to operation with pain in region of rectum, was treated for hæmorrhoids Pain at times sharp and shooting Constipation No notice of decrease of weight

*Physical Examination*—General condition good Local Mass four inches from anus attached around lumen of gut Not adherent to bladder

*Operation*—June 29, 1901 Sims's position Incision from median line of sacrum to anus, coccyx removed Mass excised, end-to-end suture of gut Sterile gauze

*Postoperative*—Pulse weak and rapid Skin cold (shock?) Died June 30, 1901

CASE 16—M R, aged fifty-three years, female, white New York Hospital, Dr Johnson Carcinoma

*Family History*—Negative for neoplasm

*History*—Was always well and strong until eight months previous to operation At that time experienced an uncomfortable sensation about the anus and in pelvic region For two months previous to operation was very constipated, movements impossible, pain severe Hæmorrhages from rectum just previous to operation, also a bloody discharge from the vagina Loss of flesh and strength

*Physical Examination*—General condition good Vaginal Near outlet of floor of vagina a hard, ulcerating mass, vagina freely movable over it Rectal So indurated and occluded that finger cannot pass

*Operation*—July 23, 1903 Perineal incision—right of centre—from vagina to anus, encircling it Tumor extended up rectum for two and one-half inches Rectum pulled down, tumor excised, and gut sutured to skin wound Posterior wall of vagina sutured to free edge of skin at anterior portion of perineal wound

*Postoperative*—July 26 Chills Temperature, 106.6° F, pulse, 140, respirations, 32 Involuntary defecation August 1 to 5 Delirious Complication, nephritis Died August 8, 1903, probably from sepsis

CASE 17—W F, aged fifty-two years, male, white Presbyterian Hospital, Dr Woolsey Epithelioma

*Family History*—Negative for neoplasm

*History*—(Syphilis and rheumatism) For three to four

years previous to operation had lumps about the anus, which were painful and disappeared on treatment For past year lumps have been permanent, are painful, bleed on defecation For eight months previous to operation had a discharge of yellow fluid continuously

*Physical Examination*—Poorly nourished, anæmic Inguinal glands somewhat enlarged, prostate not enlarged Mass on right side of rectum size of chestnut, surface uneven No enlarged glands in pelvis

*Operation*—July 15, 1900 Lithotomy position (Hæmorrhoids excised) A circular incision was made about the anus Mass pulled down and excised Skin sutured to mucous membrane over the area Gauze drain Time, thirty minutes

Discharged cured, July 25, 1900 Alive and well, March 1, 1905 Has satisfactory control over bowel No return of symptoms

CASE 18—J S, aged forty-nine years, male, white, laborer Presbyterian Hospital, Dr Briddon Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—Eight months previous to operation patient noticed blood in stools, but had no pain Two months later he experienced a dull, heavy pain in rectum, more marked at night Bowels constipated No diminution in caliber of stools No cachexia Some loss of flesh, more loss of strength

*Physical Examination*—No cachexia Hard ulcerated tumor, size of almond, felt on left rectal wall, one inch from anus, involving sphincter Prostate enlarged

*Operation*—October 18, 1899 Lithotomy position Perineal incision, distal three inches of gut excised, proximal end sutured to skin incision Sphincter muscles cut in removing the growth Hæmorrhage severe, controlled by clamp and ligation

*Postoperative*—October 20 Suprapubic cystotomy November 6 Catheter inserted for continuous drainage of bladder Delirium lasting over one month

Discharged January 31, 1900 Died February, never having regained any control over sphincter ani

CASE 19—A M, aged fifty-three years, female, white, housewife Presbyterian Hospital, Dr Brown Malignant adenoma (colloid)

*Family History*—Negative for neoplasm

*History*—Began six months prior to operation with diarrhœa and occasional passage of blood and pus in stools For two months previous to operation desire to defecate has been almost constant Movements are painful and difficult Fæces passed in small round balls Difficult to start stream in urination

*Physical Examination*—Patient fairly well nourished No enlargement of superficial glands Local Nodular mass extending two-thirds around rectum on left side

*Operation*—September 4, 1900 Prone position Hips raised Median incision sacrum to anus Sacrum and coccyx excised, rectum excised, artificial anus below site of excised sacrum No infiltration of surrounding tissue Time, two hours

*Postoperative*—Free purulent discharge from wound for over a month Pain in wound No control over bowel

Discharged cured, November 1, 1900 Died January 9, 1902, never having regained any control over bowels

CASE 20—J M M, aged forty-seven years, male, white, electrician Presbyterian Hospital, Dr Eliot Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—Nine months previous to operation had severe fall, striking coccyx on stone steps Six months previous to operation patient noticed obstruction in rectum and traces of blood in stools Later movements became ribbon shape, and after movements experienced a dull aching pain Three weeks previous to operation stream of urine became gradually smaller and urination more frequent

*Physical Examination*—Weight has increased, no enlarged glands Well nourished Local Had immovable fungating mass just within anal margin, size of plum, three inches higher up a firm annular stricture

*Operation*—October 17, 1900 Prone position Sacral flaps (Kraske) Growth adherent to bladder Rectum divided four inches from anus Free end sutured to upper outer angle of wound

*Postoperative*—Discharge from wound abundant Urinary fistula Incontinence of urine and fæces

Discharged cured, December 22, 1900 Readmitted to hospital, March 9, 1901 Rectovesical fistula Incontinence of urine and fæces Physical examination Well nourished, not anæmic,

no glands Discharged improved, March 16, 1901 Died October, 1901, never having any control over defecation

CASE 21—J C G, aged fifty-nine years, male, white New York Hospital, Dr Hartley Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—Nine years previous to operation injured spine in railroad accident Two years previous to operation had itching and bleeding piles Constipation marked Loss of flesh and strength Few months previous to operation passed blood and pus in stools Stools became smaller in caliber Urination difficult

*Operation*—June 2, 1898 Lithotomy position Perineal incision from coccyx to anus Coccyx removed Hæmorrhage considerable Growth adherent to tissues Mass excised, free end sutured to skin wound Artificial anus

*Postoperative*—Semiconscious, delirium, pain in abdomen Died June 12, 1898

CASE 22—G C M, aged sixty-three years, male, white, driver Presbyterian Hospital, Dr McCosh Carcinoma

*Family History*—Negative for neoplasm

*History*—About ten months previous to operation patient began to suffer from an indefinite pain in the abdomen, followed by frequent and painful defecation, eight to ten movements in twenty-four hours, rectal tenesmus marked Loss of sphincteric control with involuntary defecation and urination

*Physical Examination*—Local Carcinomatous mass three inches from anus, apparently no glandular involvement

*Operation*—December 13, 1898 Preparatory treatment, diet and stimulation Combined operation with sacral flap and division of sacrum at fourth interspace Upper end of rectum involved in carcinomatous mass Mass excised Lower end of sigmoid sutured to upper border of skin wound Lower end of gut clamped Iodoform gauze drain Hæmorrhage considerable, controlled by clamps

*Postoperative*—Considerable discharge from posterior wound, dark green and foul smelling Patient died, December 15, 1898, with wound in septic condition

CASE 23—M E C, aged forty-four years, female, white New York Hospital, Dr Hartley Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—Colotomy, June, 1897, after suffering from condition one year (Thought to be inoperable at time of colotomy)

*Physical Examination*—Cauliflower mass two inches beyond anus encircling entire gut

*Operation*—November 15, 1898 Semiprone position Median incision sacrum to anus Sacral flap Surrounding tissues infiltrated Mass excised, end-to-end suture of gut Time, one hour, thirty-five minutes

*Postoperative*—Considerable discharge from wound

Discharged improved, January 1, 1899 "Was well enough after operation to attend reception Had constant pain, but bowels were under comparative control Dropsy, January 5, 1900" Died January 5, 1900

CASE 24—C H, aged thirty-five years, female, white, housewife Presbyterian Hospital, Dr McCosh Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—Nine months previous to operation passed blood at stool Five weeks later, while at stool, had a piercing pain in rectum, painful and bloody defecation since, caliber of feces not diminished

*Physical Examination*—Health has been as good as usual Corpulent, anæmic Area of ulceration size of silver dollar two inches above external sphincter No stricture

*Operation*—April 2, 1898 Lithotomy position Perineal incision Coccyx resected Distal six and three-quarters inches of gut excised Proximal end sutured to anal site Glands in surrounding tissues involved Hæmorrhage considerable, controlled by clamp and sponge Gauze drain Foul purulent rectal discharge for days following operation Pain in abdomen and about anus Painful defecation and urination

Discharged May 5, 1898 Died July 22, 1899 The control over bowels was never regained

CASE 25—L M W, aged thirty-four years, male, negro, dyer Presbyterian Hospital, Dr McCosh Malignant adenoma

*Family History*—Negative

*History*—One year previous to operation noticed blood and mucus at stool Pain and tenesmus followed one month after initial symptoms, with constant desire to defecate Loss of weight and strength

*Physical Examination*—Poorly nourished, weak Epitheliomatous growth, with cauliflower formation involving lower four inches of rectum, adherent to bladder and prostate Inguinal colotomy, October 8, 1896

*Operation*—November 5, 1896 Perineal incision Part of prostate and enlarged glands removed, ten inches of rectum excised Artificial anus rectum stitched to posterior skin incision Very vascular, controlled by sterile dressing November 28 Dejecta from artificial anus

December 10 Discharged cured Doing well Died April 25, 1897 The functional control was never good

CASE 26—J R, aged thirty-five years, male, white, butler New York Hospital, Dr Murray Colloid carcinoma

*Family History*—Negative for neoplasm

*History*—Operation for tumor of rectum, St Luke's Hospital, February, 1897 Was well until April, 1898, when he reverted to condition previous to operation Marked flatulence, great constipation, digestion poor, pain on defecation, stool hard, scybalous, streaked with blood and mucus Had medical attention with diagnosis "Catarrhal proctitis" Loss of strength and twenty-five pounds weight

*Physical Examination of Rectum*—Posterior and to left indurated, flat, rough growth, reached by finger

*Operation*—September 10, 1898 Sacrum diseased, operation discontinued September 17, 1898 Lithotomy position Incision anus to coccyx Four inches of gut excised Artificial anus at upper angle of wound Anus sewed up

*Postoperative*—November 4 Posterior sinus healed

Discharged improved, November 8, 1898 Temporarily improved, condition recurred Died, 1899

CASE 27—J M, aged forty-five years, female, white, milliner Bellevue Hospital, Dr Tilton Carcinoma

*Family History*—Negative for neoplasm

*History*—Began eight years previous to operation with pruritus and pain about anus Unable to sleep at night Ten days previous to operation had bloody discharge Excessive pain on and after defecation Constant stinging pain Micturition painful

*Physical Examination*—General A little emaciated and haggard



*Operation*—September 29, 1904 Sphincter ani dilated "Lower two inches of rectum together with hard tumor removed Hæmorrhage stopped Skin and mucous membrane fastened together by black silk"

*Postoperative*—October 3 Considerable discharge from wound October 22 Slight discharge from wound

Discharged December 11, 1904 Has fair control over bowel Has recently experienced shooting pain in rectum

CASE 28—M R, Brooklyn, aged forty-seven years, female, white New York Hospital, Dr Hartley Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—Began two years prior to operation with pain on defecation and bloody discharge from the rectum Pain lately increased in severity, becoming constant in coccyx and thighs

*Physical Examination*—Fairly well nourished Local Ring of papillomatous growths constricting the lumen three inches above the anus

*Operation*—January 6, 1903 Modified Kraske End-to-end suture of gut

*Postoperative*—Discharge of fluid and mucus Complication, colitis

Discharged cured, February 22, 1903 Recurrence about July, 1904, and admitted to Presbyterian Hospital, in Dr Woolsey's service

*Physical Examination*—General Poorly nourished Rather pale, slightly cachectic Tubercular involvement of left upper lobe and slight of right upper lobe of lungs Local Nodular growth of lower end of rectum, above which is a cicatricial stricture of previous operation Rather lax sphincter

*Operation*—August 31, 1904 Position, left lateral Coccyx exposed and removed Tumor removed Perforation in the rectum closed with catgut Drain inserted Good condition

*Postoperative Condition*—Wound over the sacral region healed clean Pain completely relieved Sphincteric action weak but improving

Discharged September 18, 1904

March 15, 1905 Still living and in very fair condition Has very good sphincteric control

CASE 29—W P, aged twenty-seven years, male, white, boiler-maker Presbyterian Hospital, Dr McCosh Adenocarcinoma

*Family History*—Negative

*History*—Bleeding from rectum and pain on defecation for two years No history of cachexia

*Physical Examination*—Ulcerated mass felt on the wall of rectum low down Glandular involvement not mentioned

*Operation*—June 6, 1895 Lithotomy position Gut pulled down, stitched to skin, and end excised (four inches) Gauze drain inserted Hæmorrhage easily controlled by sponges Condition of patient good

*Complications and Sequelæ*—Considerable pain, relieved by morphine Pain on micturition Wound discharged pus, mucus, and blood Urinary fistula into rectum

Discharged cured, June 28 Function good Recurrence within two months Second operation, August 20, 1896 Discharged cured, September 7, 1896

March, 1905—Patient at work Has gained forty pounds in weight Control fair Longest period of cure recorded in this series

CASE 30—M J, aged thirty-nine years, female, white, laundress New York Hospital, Dr Markoe Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—Began eight months previous to operation with blood in stools Condition became worse from month to month Three months previous to operation had difficulty in moving her bowels For two months previous some pain, not severe Alternate attacks of constipation and diarrhœa Had three attacks of obstruction, vomiting, pain Relieved when bowels moved

*Physical Examination*—Well nourished, obese Local Mass on anterior rectal wall (ulcerating) one and one-half inches in diameter

*Operation*—January 20, 1903 Prone position Sacral flap Mass excised, one inch from growth, three-quarters from anus End-to-end suture of gut Hæmorrhage moderate, shock marked

Discharged cured, March 5, 1903 Not heard from since

CASE 31—B R, aged fifty-six years, female, white New York Hospital, Dr Stimson, Dr Johnson Adenocarcinoma

*Family History*—Negative for neoplasm

*History* —Began two years previous to operation with difficulty at stool Faeces passed in small particles, accompanied by blood and bearing-down sensation Dull ache in rectum before defecation Frequency of defecation, improved under treatment Loss of strength and twenty pounds weight

*Physical Examination* —Moderately well nourished, skin and mucous membrane of good color Local Indurated, raspberry-like mass encircling gut two inches from anus, no ulceration, no glandular involvement

*Operation* —October 31, 1903 Prone position Median incision Excision of coccyx, sacrum, and gut containing tumor, end-to-end suture of gut

Discharged cured, December 28, 1903 —“Granulations have tendency to be sluggish” Recurrence, returned to hospital

*Physical Examination* —General condition good Robust, complexion ruddy Local Large mass encircling rectum one and one-half inches deep

*Operation* —May 23, 1904 Dr Johnson Mass excised Rectum sutured to sacral end of skin wound

Discharged, improved, June 13, 1904

Has been in bed over four months, cannot sit up because wound pains her so Wound does not heal Has no control over bowel No return noticeable Has suffered since operation with la grippe, dysentery, and dyspepsia

CASE 32 —A B, Brooklyn, aged forty-nine years, female, white, seamstress New York Hospital, Dr Bolton Carcinoma

*Family History* —Negative for neoplasm

*History* —Habitual constipation Four months previous to operation, experienced painful defecation Constipation severe, soon after blood in stools, stools small Lost twenty pounds Indigestion marked

*Physical Examination* —Anæmic Local Ulcerated rough area close to anus constricting gut

*Operation* —August 7, 1901 Sims's position Kraske Sphincter and anus excised, coccyx removed, gut, including mass (six inches), excised End of gut twisted and sutured to wound Hæmorrhage slight

*Postoperative* —Discharge yellow, odor strong

Discharged cured, September 25, 1901

Patient doing fairly well, weighs twenty-five pounds more

than before operation Discharge from wound still present No control over defecation

CASE 33—L D G, aged forty-four years, male, white New York Hospital, Dr Weir Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—Two months previous to operation began to have dull aching pain at defecation, with passage of small amounts of blood in stools No loss of flesh or strength Bowels regular

*Physical Examination*—Ulcerated, indurated mass one inch above anal margin, extending up two and one-half inches, involving one-third circumference of rectal wall

*Operation*—Colostomy, April 25, 1898 May 12, 1898 Sims's position Median perineal incision Lower three inches of rectum excised Free end sutured to upper angle of skin wound

*Postoperative*—Artificial anus, May 28, 1898 Discharged, improved, June 30, 1898 Not reported later

CASE 34—I C, aged fifty-five years, male, white, engineer Presbyterian Hospital, Dr Eliot Carcinoma

*Family History*—Negative for neoplasm

*History*—Good health until one month previous to operation, became very constipated Used Sal Rochelle, Liq Mag Cit, Castor Oil, and enemata with but little result By persistent catharsis had two or three stools during the month Stools were fluid (otherwise not noted) Considerable prostration

*Physical Examination*—Well nourished, not anæmic Mass on right side of rectum can be touched by finger, limits not definable

*Operation*—Previous colotomy, July 24, 1898 September 7, 1898 Sims's position Sacral flap, with division of sacrum between fourth and fifth segments Mass size of small orange removed (four inches above anus) End-to-end suture of gut

*Postoperative*—Considerable discharge from wound of pus and mucus Healing by granulation Belladonna and opium suppositories for pain Discharged cured, October, 1898

Died March 18, 1900, from pneumonia Never regained control over bowels

CASE 35—M M, aged seventy years, female, white, housewife Presbyterian Hospital, Dr Briddon Malignant adenoma

*Family History*—Negative for neoplasm

*History*—Began one year previous to operation with constipation, straining and pain at stools Considerable loss of weight and strength

*Physical Examination*—Well nourished Small cauliflower growth size of walnut projecting from anus, another smaller mass two inches from sphincter

*Operation*—September 29, 1897 Lithotomy V-shaped incision including anus and vulva as high as meatus urinarius Posterior vaginal wall involved in mass Inguinal glands not enlarged End of gut excised Wound closed with silkworm gut Hæmorrhage moderate Discharged cured, October 15, 1897 Function good

Admitted June 7, 1900, to Home for Incurables

*Physical Examination*—Hard mass in rectum occluding lumen

Died November 3, 1900, from recurrence

CASE 36—C S, aged sixty-seven years, female, white New York Hospital, Dr Bolton Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—More or less dysentery for last sixteen years For a few years previous to operation alternated with constipation, and noticed a small amount of blood in stools Four or five months previous to operation had considerable bearing-down pains, particularly when bowels moved Severe hæmorrhage one week before operation Some loss of weight and strength

*Physical Examination*—Poorly nourished, anæmic Local On posterior wall, one inch from anus, is a tumor projecting forward three-quarters of an inch, surface uneven, ragged, firm consistency, one and one-half by two inches No glandular enlargements felt

*Operation*—August 10, 1901 Sims's position Median incision from anus upward Elliptical area bearing tumor removed Cut edges of rectum and sphincter joined Wound through skin left open Hæmorrhage slight

*Postoperative*—Uneventful Discharged cured, September 29, 1901

Alive and well, February, 1905 Has perfect control over action of bowels

CASE 37—J D, aged fifty-two years, male, white, laborer

New York Hospital, Dr Murray Adenocarcinoma—rectum and glands

*Family History*—Negative for neoplasm

*History*—Began about nine months previous to operation with blood in stools One month after passage of blood had pain in the hips, pain constant and “bursting” in character Pain and amount of blood in stool increased with time More diarrhoea than constipation Became too weak to work Lost twenty pounds in two and a half months

*Physical Examination*—Alcoholic, emaciated Inguinal glands enlarged Rectal Just within the anus, extending up two and one-half inches, an ulcerating growth involving one-half circumference of gut, edges hard

*Operation*—Preliminary colostomy, March 29, 1904 April 9, 1904 (a) Incision encircling anus, coccyx removed, mass excised, wound closed with deep suture (b) Inguinal glands of right side excised May 9, 1904 Excision of metastatic inguinal gland on right side, under cocaine Discharged, improved, May 30, 1904

February 15, 1905 In Metropolitan Hospital, described as “having lumps breaking out on legs” One leg much swollen There is a general recurrence in pelvis Has very fair control through colostomy anus

CASE 38—J W, aged forty-three years, married, male, white, bartender Presbyterian Hospital, Dr Woolsey Malignant adenoma

*Family History*—Negative

*History*—Always very constipated, two to three days No neoplasm elsewhere Blood in stool two months before admission (July 4, 1901), only with defecation, no pain One month, pain with defecation localized in rectum, not referred, bleeding with and without defecation, amount increasing No obstruction Can only urinate after defecation

*Physical Examination*—General Fairly well nourished, somewhat anæmic, otherwise negative Local Uneven villous-like growth just within sphincter all over rectum except left side Seems continuous with prostate on right Right lobe of prostate nodular and firm Tumor hard, bare, infiltrated, smooth, irregular, not tender

*Operation*—September 11 (Inguinal colostomy, September

4) Position right lateral Coccyx and sacrum at level of third foramen removed Much hæmorrhage Rectum freed and resected from between external and internal sphincters to an inch above growth Peritoneum stripped up Silk retention sutures passed through proximal end before cutting slit in posterior surface of rectum Sponges inserted Rectum cut Fat and lymph nodules cleaned from pelvis Proximal end sutured by mucous membrane to anus, connective tissue to sphincter Wound packed with gauze Rectum closed at colostomy wound by gauze in distal end Condition good

*Postoperative*—Bowels moved by colostomy wound on third day, by anus on sixth day Sutures separated and rectum retracted two inches by the fourteenth day Sacral wound closed clean by granulation at end of four months Complications, attack of diarrhoea with pain on two occasions Fæcal discharge from sacral wound for many weeks following operation Discharged January 14, 1902, with occasional fæcal discharge from colostomy wound, and granulating sinus one inch deep and three-quarters by one-half inch, through which about one-half fæcal matter is discharged Gained ten pounds in weight

March 1, 1905 The sacral wound and rectal opening have entirely healed, so that all movements come through the colostomy wound He has very fair control over this It shows a tendency to stricture, which is controlled by bougies passed once a week

CASE 39—M C, aged forty-five years, male Bellevue Hospital, Dr Woolsey Pathological Report, Adenocarcinoma

*Family History*—No malignancy

*History*—For more than a year prior to operation he had pain due to fissure For six months pain had been severe, and he had noticed blood in stools There was no loss in weight or strength and no impairment of general health

*Physical Examination*—November 28, 1904, general condition good Local A fissure in ano is present At finger length up in rectum there is a growth (nature of this not noted) December 1, 1904 Lateral colostomy

*Operation*—December 28, 1904 Incision over sacrum, coccyx, and into perineum Coccyx and left side of third lower sacral vertebra removed Rectum freed and three inches, including growth, resected End-to-end suture, leaving anal sphincter intact

*Postoperative*—Wound badly fouled with fæces, marked sloughing Retraction of sutured gut and gaping of wound March 15, 1905, still in hospital Has involuntary defecation through both wounds Posterior wound not yet healed

CASE 40—W R, aged sixty-nine years, male, white, painter Presbyterian Hospital, Dr McCosh Pathological Report, Adenocarcinoma

*Family History*—Negative for neoplasm

*History*—Hæmorrhoids to a certain extent Six months ago (April 16) first noticed involuntary watery discharge from anal orifice, no blood nor pain One week ago blood in stools Examined by physician Ulcer of rectum Operation advised No loss of weight, pain or bladder disturbance

*Physical Examination*—General Well nourished and in good health Local Prostate enlarged On posterior wall an irregular projecting cauliflower-like mass extending into lateral walls in crescentic manner, firm Examining finger returns bloody

*Operation*—No previous colostomy October 20, modified Kraske Sims's position (on right side) Removal of coccyx and lower half of sacrum Hæmorrhage free but not excessive, peritoneum not opened Involved glands and fat removed Six inches of rectum removed Proximal end sutured to upper end of wound Large drainage-tube inserted Time, one hour, ten minutes Condition excellent

*Postoperative*—Bowels constipated by Pil Opii Wound dressed on second day, clean Considerable oozing Bowels moved on seventh day Catheterized for thirty days No cystitis

General progress excellent, gained in weight and flesh Discharged December 3 Sacral wound nearly closed, granulating area three-quarters of an inch deep

March 1, 1905 No recurrence Has no fæcal control and is very despondent, threatening suicide Sacral sinus still persists

CASE 41—W I, aged seventy years, male, white, mason Presbyterian Hospital, Dr McWilliams Pathological Report, Adenocarcinoma

*Family History*—Negative for cancer

*Previous History*—Negative for rectal conditions

*Initial Symptoms*—Three years ago (1901) noticed some



blood in stools, soon followed by constipation, requiring constant catharsis Without cathartic goes three or four days, but constant desire At times a pint of clotted blood No pain, vomiting, or bladder trouble Gradual increase in bleeding and constipation Fifty pounds lost in three years

*Physical Examination*—General Obese and florid, otherwise negative Local One finger's length above anal orifice a hard, crater-like mass in posterior wall, slightly movable, friable, seems attached to sacrum Markedly encroaching on lumen of rectum No glands felt

*Operation*—June 22, 1904 Quarter grain morphine before operation Position, knee-chest Removal of coccyx and one inch of sacrum Total resection of rectum, burned through with cautery Hæmorrhage moderate, controlled by clamps and hot saline Proximal end could not be drawn down, so was closed with plain gut and droppped back into wound, which was packed with gauze and rubber tube Lateral inguinal colostomy

*Postoperative*—Sacral wound suppurated profusely, discharge foul and fæcal Upper sutures did not hold Considerable bloody oozing Colostomy wound in good condition Sphincteric action poor Had to be catheterized first thirty-six hours Later, occasional fæcal discharge through sacral wound After first week a septic temperature, profuse purulent discharge from sacral wound At end of one and a half months from operation patient is still discharging some fæcal matter from sacral wound September 30, 1904 Secondary colostomy, by intermuscular method, with band of external oblique fascia as constricting sphincter, completely cutting off portion of gut distal to colostomy opening Following this the sacral wound healed in rapidly by granulation No more fæcal discharge Discharged, December 17, with an imperfect sphincteric action of colostomy and small granulating area in sacral wound General condition good

March 15, 1905 He is in good health, and enjoys good control over the action of the colostomy anus There is a tendency to contraction of the skin orifice around the gut end This is corrected with bougies

CASE 42—J K, aged forty-four years, male, German, was admitted to the French Hospital, Dr Peck, May 29, 1897, with a history of pain on defecation dating back fifteen months Later, constipation, blood in stools, loss of flesh and strength, for six

months unable to sit in chair on account of pain For fourteen days prior to admission had had no passage of fecal matter or gas, intense pain and continuous vomiting for several days Abdomen was greatly distended and tense, pulse rapid and feeble, expression anxious, skin cool and cyanotic Large constricting neoplasm of rectum felt about four inches from anus

Inguinal colostomy by lateral adhesion performed immediately (May 29, 1897), patient rallied rapidly, and insisted on an operation for removal of the growth in spite of an unfavorable prognosis

Kraske's operation performed July 16, 1897, with removal of three and one-half inches of bowel and several very much enlarged sacral glands About one inch of anal portion of gut preserved and upper segment sutured to it, sphincter divided posteriorly Wound healed with very moderate sepsis, although the colostomy opening failed to divert the fecal current from the lower bowel, some of the posterior stitches gave way

Plastic operation to close posterior defect in rectum, October 27, 1897, partially successful, final result being very fair sphincteric control, with only from two to four evacuations daily

Closure of inguinal colostomy by suture February 17, 1898, healing by primary union Condition quite comfortable for nearly two years, local recurrence, quite extensive, noted July 31, 1899, marked pain and cachexia noted October 27, 1899, cachexia progressive, and severe pain from then to death, three years after the radical operation The closure of the colostomy opening on February 17, 1898, was permanent, and there was never any return of obstruction

CASE 43 —K D, aged thirty-nine years, female Presbyterian Hospital, February 10, 1905, Dr McCosh Adenocarcinoma

*Family History* —Negative for neoplasm

*History* —Troubled with bleeding from hæmorrhoids(?) for fifteen years During three months prior to operation she suffered pains in rectum and increasing constipation No bleeding during this time

*Physical Examination* —General condition good, showing no cachexia Local There is a rough, indurated mass two and one-half inches up, infiltrating the posterior and right rectal wall, upper limit not determined

*Operation*—No preliminary colostomy Sims's position on right side Incision downward from lower sacrum over coccyx into perineum Examination showed sphincters could not be saved Lower sixth of rectum was amputated, end sutured to upper angle of wound An attempt to pass bowel through gluteus failing because of difficulty in bringing it down

*Postoperative*—Wound became fouled with fæces Gut tore away and retracted two inches Patient was quite septic for three weeks Had no control over movements At present, March 16, one month after operation, there is a large granulating cavity in sacral region, with rectum two inches deep in it, from which involuntary defecation takes place General condition good

CASE 44—S R, aged forty-eight years, male, colored Lincoln Hospital, Dr Hartwell Carcinoma

*Family History*—Tubercular, no malignancy

*History*—In 1899 he had an ischiorectal abscess which healed without treatment Recurred in 1901, and was operated on Shortly after this he began to suffer from some rectal tenesmus and incontinence, which have grown continually worse For some months past there has been a purulent discharge from the rectum, and his general condition has failed During the past month he has lost thirty-five pounds in weight His general condition on admittance to the Lincoln Hospital on May 9, 1904, was poor He was very anæmic and moderately emaciated Rectal examination showed an indurating tumor which encroached on the sphincter and extended upward, involving the greater part of the rectal wall for a distance of three inches The sphincteric control was completely lost, and the growth apparently had its origin in the tract of the old abscess

*Operation*—May 23, 1904 Colostomy Intermuscular method, proximal end beneath anterior sheath of rectus muscle and out at midline Distal end sutured in primary wound Healed kindly Had fair control over movements General condition improved

June 21, 1904 Exaggerated knee-chest position Incision from lower sacrum downward surrounding the anus Resection of coccyx and one-half sacral segments Rectum closed below Freed from its bed, dissected off prostate and bladder and drawn out about eight inches Amputated between two ligatures and proximal end closed Wound partly sutured and drained with gauze Shock very moderate

June 29, the wound healed kindly with very little discharge. Patient gradually lost strength, however, and died from lack of power to react, a condition often noted in colored patients. There was neither local nor general evidence of sepsis.

CASE 45 — J. E., aged thirty-seven years, male, Lincoln Hospital, Dr. Lambert. Carcinoma.

In June, 1903, began to suffer from increasing constipation and pain about rectum. In the summer of 1904 blood appeared in stools. Entered Lincoln Hospital, October 20, 1904.

*Physical Examination* — Some emaciation. Rectal. A finger's length from the anus there is a constriction, which just admits tip of finger and due to an indurating growth involving entire wall and circumference of rectum. October 27. Radical removal of the growth through a perineal incision with splitting of the anus, but without removal of the sphincter. About eight inches of rectum was resected and the proximal end sutured to anal margin, wound then partly closed with drainage.

November 4. Failure of union in sutured gut. Fouling of whole wound with feces. General condition of sepsis. To correct these conditions an inguinal colostomy was done by intra-muscular method, using rectus muscle and its anterior sheath as a sphincter. Following this the sacral wound cleared and healed kindly.

March 22, 1905. He is in excellent condition. He has very fair control over movements through colostomy anus, and is gaining constantly in this respect. Is filling position as engineer in large factory.

CASE 46 is reported in full in record of cases presented at the New York Surgical Society, for which see page 275.

## SUMMARY AND CONCLUSIONS

Number of cases, 46, — 26 males, 20 females. Youngest, 23 years, oldest, 70 years (2 cases).

In the third decade, 5 cases, in the fourth decade, 9 cases, in the fifth decade, 14 cases, in the sixth decade, 11 cases, in the seventh decade, 5 cases, in the eighth decade, 2 cases.

*Results* — Died from operation, 12 cases, or 26 per cent, 7 dying from infection, *i. e.*, 58 per cent of all the deaths.

Died from recurrence in less than two years and more

TABLE OF

Number Name Operator Hospital	Age	Sex	Histological Structure	Nature of First Symptoms and Duration of Disease	Local Condition	Cachexia	Inguinal Colos- tomy
No 1 I S Dr Bolton, New York	34	F	Adenocar- cinoma	Bleeding and pain, 4 months	Nearly impassable stricture $3\frac{1}{2}$ inch- es from anus	No	Lateral
No 2 K Dr McCosh, Pres- byterian	46	F	Malignant adenoma	Bleeding, diar- rhoea, 9 months	Not stated		No
No 3 F L Dr Tilden Brown, Presbyterian	25	M	Adenocar- cinoma				No
No 4 J M Dr McCosh, Pres- byterian	56	M	Carcinoma	Bleeding, increas- ing diarrhoea and pencil stools, pain 9 months	Hard ragged mass on anterior wall $1\frac{1}{2}$ inches from anus		No
No 5 M W Dr Hartlev, New York	23	M	Gelatinous carcinoma	Tenesmus mild bleeding consti- pation diarrhoea, 1 month, history of perineal trau- ma 10 years pre- vious followed by bleeding	Tight ring $1\frac{1}{2}$ inch- es from anus Sec- ond ring $\frac{1}{2}$ inch higher Bleeding free from exami- nation		Lateral (?) for obstruction at suture site 3 months after radical opera- tion
No 6 P W Dr Tilton, Belle- vue	42	M	Carcinoma clinically	Constipation pro- gressing over period of 5 years	Hard nodular growth obstruct- ing rectal lumen	No	No
No 7 J M G Dr Hartwell, Bellevue	60	M	Carcinoma	Pain for 6 months, bleeding 4 months	Hard, friable growth, $1\frac{1}{2}$ inches from anus Lumen much constricted Inguinal glands enlarged and hard	Yes	Complete, with both ends in parietes Prox- imal end be- neath sheath rectus
No 8 F S Dr Elhot Presby- terian	60	F	Malignant adenoma	Pain and difficult defecation for 2 years, bleeding	Internal hæmor- rhoids Hard nodules surround- ing gut at internal sphincter	Yes	No
No 9 A R Dr Murray, New York	49	F	Carcinoma	No symptoms ex- cept constipation, which was habit- ual until 1 month prior to opera- tion when ob- struction to ene- ma nozzle was noted	Nodular mass com- pletely surround- ing gut in region of sphincter Ex- trarectal tissue involved	No	No
No 10 C M M Dr Hartwell, Bellevue	27	F	Carcinoma	Bleeding and pains for few months	Encircling friable mass 3 inches from anus Caliber gut nearly occluded Bleeds easily Up- per limit not reached	Marked	Complete as to temporary anus Both ends in wound
No 11 A W Dr Briddon, Presbyterian	58	F	Malignant adenoma	Pain and bleeding, 9 months hæm- orrhoids 12 years ago	Tumor size hen's egg above internal sphincter		No
No 12 R H Dr Weir, New York	58	M	Carcinoma	Bleeding and pain, constipation, 1 year Treated for hæmorrhoids	Large mass 2 inch- es above anus ex- tending entirely around gut		Lateral 2 weeks prior to resec- tion

## CASES

Type of Radical Operation	Postoperative History	Result and Time in Hospital	Late Results	Remarks
Sacral route 4 inches resected End to-end suture	Passes through both anal Suppuration and sepsis	Lower wound granulating, 3 months	1 year general condition good Fair function through colostomy Anal fistula open	Had second operation, nature not known
Perineal route Removal coccyx 10 inches resected End to end suture 1½ inches up	Contraction caused stricture Dilated	"Improved," 4½ months	Died Date not determined	The course of wound healing is not given
Sacral route Resection and end to-end suture		Healed, 1 month	Died soon after leaving hospital	Recurrent operation The first 4 years earlier Details not known
Perineal route Coccyx resected Amputation of distal segment, proximal sutured to perineum		Died on third day		
Kraske 3 months later division of recurring stricture and colostomy	Slowly granulating sacral wound	Discharged improved in 3 months	Died short time later	Recurrence was evidently early
Sacral route Resection rectum at site of growth and sutured the proximal end to anal mucous membrane Sacral gland removed		Healed Left hospital in 3 months	Alive and healthy at present, 11 months after operation Bowels under partial control though often involuntary Stricture at gut union which required section 1 week ago Bowels less controlled since	Note tendency to stricture when anus is so arranged as to give fair control
4 weeks later sacral route Amputation, 6 inches, including anus, glands and areolar tissue removed <i>en masse</i> end sutured and dropped in pelvis	Primary union except at drain point No suppuration	Complete healing in 7 weeks Discharged in 1 month	8 months, no return Colostomy with excellent control	Inguinal gland removed for examination showed no cancer
Kraske method	Marked suppuration and sloughing	Died in 3 weeks from chronic sepsis and inanition		Very advanced case in patient of poor resistance
Perineal method Amputation, including anus Gut sutured to skin Some growths left in soft parts (?)	Clear healing by granulation	Discharged in 1 month Healed	Died from recurrence in 22 months Excellent sphincteric control	Note control in absence of muscles
Sacral route 10 days later 4 inches of gut resected leaving sphincters Proximal end to anal by suture Much shock	Rested poorly Progressive weakness Only slight suppuration, but evidence of sepsis	Died in 6 days without any good reaction after operation Sepsis to some extent		Patient showed poor resistance after colostomy Radical operation done too soon after colostomy
Sacral route Resection with end to end suture	Much infection in wound Peritonitis (?)	Died on fourth day from sepsis		
Sacral route 6 inches resected, saving sphincter End to-end suture	Much faecal leakage in wound	Died on fourth day probably from shock and sepsis		

TABLE OF

Number Name Operator Hospital	Age	Sex	Histological Structure	Nature of First Symptoms and Duration of Disease	Local Condition	Cachexia	Inguinal Colos- tomy
No 13 F N Dr Weir, New York	52	M	Carcinoma	Bleeding and pain, 9 months	Hard nodular, bleeding mass en- circling rectum from 1 inch above anus as high as finger can reach		Yes 16 days before resec- tion
No 14 I M Dr Markoe, Dr Hartley, New York	37	F	Adenocar- cinoma		Large mass on rec- tum on Douglas's pouch	Yes	No
No 15 T B Dr Hartley, New York	33	M	Carcinoma	Pain, constipation Treated for hæm- orrhoids, 4 months	Mass 4 inches from anus attached around lumen of gut	No	No
No 16 M R Dr Johnson, New York	53	F	Carcinoma	Discomfort and in- creasing rectal obstruction for 9 months	Rectum completely occluded just above sphincter by mass which bulges into vagina	No	No
No 17 W F Dr Woolsey, Presbyterian	52	M	Epithelio- ma	Syphilitic Specific ulcers around anus for 4 years	Mass in right anter- ior rectum size of chestnut Surface uneven, growth superficial	Moder- ate	No
No 18 J S Dr Briddon, Pres- byterian	49	M	Adenocar- cinoma	Bleeding and pain, 1 year	Hard, indurated tumor 1 inch from anus on left rectal wall Sphincter involved Large prostate		No
No 19 A M Dr Briddon, Presbyterian	53	F	Malignant adenoma	Bleeding, pus, diar- rhœa, 6 months	Nodular mass ex- tending two thirds around rectum on left side		No
No 20 J M Dr Eliot Pres- byterian	47	M	Adenocar- cinoma	Obstruction to def- ecation, bleed- ing, 6 months	Hard, fixed, fungat- ing mass just above anus size of plum 4 inches from anus a hard, annular stricture, adherent to blad- der	No Well nour- ished	No
No 21 J G Dr Hartley, New York	59	M	Adenocar- cinoma	Old history of hæmorrhoids Constipation, free bleeding, pus sev- eral months		Yes	Lateral
No 22 J M Dr McCosh, Pres- byterian	63	M	Carcinoma	Diarrhœa tenes- mus, involuntary fæces	Mass 3 inches from anus	?	No
No 23 M C Dr Hartley, New York	44	F	Adenocar- cinoma	Suffered 1 year, then colostomy as palliative	Cauliflower mass 2 inches from anus encircling entire gut		Lateral 17 months before resection as palliative
No 24 C H Dr McCosh, Presbyterian	35	F	Adenocar- cinoma	Bleeding and pain, 9 months	Area of ulceration size of silver dol- lar 2 inches above external sphinc- ter No stricture	No	No
No 25 L M Dr McCosh, Presbyterian	34	M	Malignant adenoma	Bleeding and mu- cous discharge, 1 year, pain, 11 months	Cauliflower growth over 4 inches of rectum above anus adherent to pros- tate and bladder	Yes	Yes

## CASES—Continued

Type of Radical Operation	Postoperative History	Result and Time in Hospital	Late Results	Remarks
Sacral route Re-section Marked shock and hemorrhage		Died on following day without reaction		
Abdominal route Mass removed	Had recovered in one month Second operation for removal failed to heal	Died in 3 months Faecal sinus remaining open		Probably primary in pelvic tissue following extensive adnexa inflammation
Coccyx removed Perineal route Resection growth End to end anastomosis	Did not react well	Died following day from shock		
Perineal route Amputation of lower 5 inches of gut End sutured in skin	Extensive fouling of wound with faeces Much suppuration and general sepsis	Died in 16 days from sepsis		Marked extra-rectal involvement, but growth was entirely removed
Excision of mass and suture of mucous membrane above to skin Sphincter not removed	Healed promptly	Discharged in 10 days	Well after 33 months No return of growth Complete control of bowels	Growth was in mucous membrane only Similar tumor clinically had healed with mixed treatment
Perineal incision Resection of 3 inches of bowel and gut sutured to skin	Much infection Cystitis Healing fair	Discharged in 3½ months Healing incomplete and in voluntary defecation	Died 4 months after operation Never really recovered No sphincter action	
Sacral route Amputation of lower part of rectum End sutured in sacral wound	Wound infected Suppuration marked	Discharged in 2 months No control over bowel	Recurrence in 4½ months Died in 16 months No control over bowels regained	Lived 1 year after recurrence was noted
Sacral route Amputation of 4 inches of rectum End sutured to upper angle wound	Faecal fouling of wound Urinary fistula developed Suppuration	Discharged in 2 months having incontinence of faeces and urine	Died in 12 months without regaining any control over sphincter Confined to bed all the time	Growth evidently involved outer coats of bladder
Perineal route Coccyx removed Excision lower end of rectum End sutured to skin	Shock Sepsis? Abdominal pain	Died on tenth day from sepsis probably		
Sacral route Re-section segment of rectum Proximal end sutured in sacral wound Lower segment clamped	Marked fouling of wound Free suppuration	Died on 23d day from shock and sepsis		Hemorrhage very severe, so that patient's condition prevented end to-end closing of rectum
Sacral route Mass resected End to end anastomosis	Considerable discharge from wound	Discharged in 6 months with wound in good condition	Died in 13½ months Control over bowels fair Could attend to social duties Developed dropsy before death	Growth considered inoperable when colostomy was done Radical removal 17 months later Lived 13 months more, i.e., 30 months after colostomy
Coccygeal and perineal route 6¾ inches amputated Proximal end sutured to skin Glands involved	Wound became contaminated with faeces Slow in healing	Discharged in 5 weeks Wound still open Incontinence of faeces	Died in 15 months Never regained control over bowels Died from asthma Recurrence not known	
Perineal route Amputation 10 inches of rectum End sutured into skin wound	Posterior wound healed kindly	Discharged in 6 weeks Colostomy anus open Control not mentioned	Died in 6 months, "never having recovered"	Colostomy apparently prevented infection in lower wound



TABLE OF

Number Name Operator Hospital	Age	Sex	Histological Structure	Nature of First Symptoms and Duration of Disease	Local Condition	Cachexia	Inguinal Colos- tomy
No 26 J R Dr Murray, New York	35	M	Colloid car- cinoma	Bleeding, pain, con- stipation, dura- tion not given	Posterior and to left hard, flat growth just reached by finger	Yes	No
No 27 J M D Dr. Tilton, Bellevue	45	F	Carcinoma	Old history of pru- ritism, bleeding only 10 days prior to operation		Moder- ate	No
No 28 M R Dr Hartley, New York, Dr Brown, Pres- byterian	47	F	Adenocar- cinoma, recurrence same	Bleeding and pain, 2 years	Ring of villous growths constrict- ing lumen 3 inches from anus	No	No
No 29 W P Dr McCosh, Presbyterian	27	M	Adenocar- cinoma	Bleeding and pain, 2 years	Ulcerated mass on left side low down	No	No
No 30 M J Dr Markoe New York	39	F	Adenocar- cinoma	Bleeding, 8 months, partial obstruc- tion for 4 months	Ulcerating mass on anterior rectal wall $1\frac{1}{2}$ inches in diameter	No	No
No 31 B R Dr Stimson, New York	56	F	Adenocar- cinoma	Bleeding, pain, ir- regular action of bowels, 2 years	Hard mass encirc- ling gut 2 inches from anus No ul- ceration	Moder- ate	No
No 32 A B Dr Bolton, New York	49	F	Carcinoma	Habitual constipa- tion, pain and bleeding, 4 to 3 months	Ulcerated, rough area close to anus, constricting gut	Moder- ate	No
No 33 L D G Dr Weir New York	44	M	Adenocar- cinoma	Pain and bleeding, 2 months	Ulcerated, hard mass from 1 to $3\frac{1}{2}$ inches from anus over one third bowel circumfer- ence	No	Yes, as prelim- inary
No 34 I C Dr Eliot, Presby- terian	55	M	Carcinoma	Constipational most complete, ex- tending over only 1 month No oth- er symptom	Mass on right side of rectum just reached by finger	No	Yes, lateral, 6 weeks prior to radical opera- tion to relieve obstruction
No 35 M M Dr Briddon, Presbyterian	70	F	Malignant adenoma	Constipation and pain, 1 year	Small cauliflower growth projecting from anus Sec- ond mass 2 inches from anus	No	No
No 36 C S Dr Bolton, New York	67	F	Adenocar- cinoma	Diarrhoeal tenden- cy for several years prior to op- eration Occa- sional bleeding Pain marked, 4 months	Tumor on posterior wall 1 inch from anus $\frac{3}{4}$ inch thick by $1\frac{1}{2}$ and 2 inches, ragged, firm	Yes	No

CASES—Continued

Type of Radical Operation	Postoperative History	Result and Time in Hospital	Late Results	Remarks
Coccygeal and perineal route 4 inches of gut amputated End sutured to angle of wound	Healing rather prompt and with out much suppuration	Discharged in 7 weeks Wound healed and condition good	Growth recurred in few months, and he died in less than a year	Very extensive condition Growth had been removed year prior to this operation, but not radically Benign (?) Sacrum was involved at time of radical operation
Sphincter split Lower 2 inches of rectum amputated together with growth Gut sutured to skin	Healed with very little suppuration	Discharged in 10 weeks with complete healing of wound	Good condition at present, 6 months Fair sphincteric control, though can not retain feces when desire to defecate arises	
Kraske Resection of piece and end-to-end suture	Wound healed well and anastomosis united	Discharged in satisfactory condition in 6 weeks	Recurrence in 18 months control having been "fairly good" Recurrence at site of anastomosis Excised through old sacral wound Healed kindly Has fair sphincter control, 26 months after first resection	Whole history extends over 3½ years Now has tuberculosis
Perineal route 4 inches amputated End sutured to skin	Considerable suppuration, but healed well	Discharged in 1 month with good control	Growth recurred in 2 months Excised second time 14 months after operation Alive and well with good sphincter action after 9 years and 8 months	Note prompt recurrence and successful removal with permanent cure
Sacral route Resection about 3 inches End to-end anastomosis		Discharged cured in 11 weeks	Not heard of after that	
Sacral route Resection End to-end anastomosis	Wound healed slowly and incompletely	Discharged in 6 weeks	Recurred locally in few months Excision, lower end of gut sutured to skin Living but in poor condition, involuntary evacuations 9 months later confined to bed because of weakness and pain	
Kraske Amputation 6 inches of lower rectum End twisted and sutured to skin	Some fouling of wound Healing, however, satisfactory	Discharged in 7 weeks Wound not entirely healed	In good condition at present, 3½ years later No sphincter control Sinus in sacral region still present	
Perineal route 3 inches of rectum excised End sutured to upper angle wound		Discharged "improved" in 6 weeks Colostomy functioning	Not reported after leaving hospital	
Sacral flap Resection of mass size of small orange 4 inches up End to end anastomosis	Infection of wound and free suppuration Healed by granulation	Discharged in 6 weeks	Died of pneumonia (?) 18 months later No sphincter at anus Condition at colostomy not noted	Note lack of sphincteric control even at high resection
Vaginal and perineal route Post vaginal wall and lower end of gut excised Gut sutured in wound	Healing satisfactory	Discharged in 1 month Function good	Recurrence locally 33 months later, from which she died 38 months after excision	Note good function with no anal muscles
Posterior incision Growth excised by elliptical incision Wound in gut closed and sutured to sphincter Later not disturbed	Satisfactory No difficulty in healing	Discharged in 7 weeks	Alive and well at present 4½ years later Has complete control	Note permanent cure with comparatively slight operation

TABLE OF

Number Name Operator Hospital	Age	Sex	Histological Structure	Nature of First Symptoms and Duration of Disease	Local Condition	Cachexia	Inguinal Colos- tomy
No 37 J D Dr Murray, New York	52	M	Adenocar- cinoma	Bleeding, pain, di- arrhea, 9 months	Just within anus and up for 2½ inches, ulcerating, hard growth, in- volving one-half gut circumference	Moder- ate	11 days prior to radical opera- tion, intermus- cular complete colostomy done
No 38 J W Dr Woolsey, Presbyterian	43	M	Malignant adenoma	Habitual constipa- tion Bleeding and pain, 2 months	Uneven villous like growth just within sphincter, nearly surrounding rec- tum	No	Lateral, 1 week prior to radi- cal operation
No 39 M C Dr Woolsey, Bellevue	45	M	Adenocar- cinoma	Pain and bleeding for 6 months Di- agnosed as fis- sure	Growth high up in rectum Fissure also present	No	Lateral, 1 month prior to radical opera- tion
No 40 W R Dr McCosh	69	M	Adenocar- cinoma	Loss of fecal con- trol, 6 months Bleeding and pain, 1 week	Irregular, cauliflower mass ex- tending over pos- terior half of rectal wall above pros- tate Bleeds easily	No	No
No 41 W J Dr McWil- liams, Presby- terian	70	M	Adenocar- cinoma	Bleeding constipa- tion about 2 years	Finger's length up is hard, crater like growth on poste- rior rectal wall Seems adherent to sacrum	No	Lateral at time of radical op- eration be- cause end could not be drawn into wound Inter- muscular later with both ends lower segment closed
No 42 J K Dr Peck, French	44	M	Typical car- cinoma	Pain and constipa- tion for 1 month Bleeding for over 6 months	Large, constricting, tumor 4 inches from anus Com- plete obstruction for 14 days	Yes	Lateral to re- lieve obstruc- tion Closed by operation 10 months later
No 43 K O Dr McCosh, Presbyterian	39	F	Adenocar- cinoma	Hæmorrhoids 15 years Pain and increasing con- stipation, 3 months	Rough, indurated, No mass 2½ inches from anus	No	No
No 44 S R Dr Hartwell, Lincoln	48	M	Carcinoma	Old fistula Puru- lent discharge and bleeding for several months	Ulcerating tumor from anus up for 3 inches, sur- rounding whole rectum	Yes Marked	Complete by in- termuscular method under rectal sheath Distal end in primary wound
No 45 J E Dr Adrian Lam- bert, Lincoln	37	M	Carcinoma	Pain in lower ab- domen and in- creasing consti- pation for 15 months Bleed- ing only 1 month	Constricting mass 3 inches from anus Hard, involving thickness of rectal wall	Moder- ate	Yes Complete Proximal end under anterior sheath of rec- tum Distal end closed 8 days after radi- cal operation to control sep- sis below
No 46 M D Dr Hartwell Lincoln	26	F	Carcinoma	Bleeding and pain for 2 years In- terference with parturition (?)	Complete rupture of perineum Mass 2 inches from an- us, constricting bowel Whole area badly in- fected	Marked	Complete by open meth- od 9 weeks prior to radi- cal operation

CASES—*Concluded*

Type of Radical Operation	Postoperative History	Result and Time in Hospital	Late Results	Remarks
Perineal route Coccyx removed Excision of rectum and mass Wound closed Metastatic glands removed from inguinal region	Healing of wound apparently good Colostomy open	Discharged in 3 weeks, posterior wound having healed	Alive now 10 weeks after operation, but has general return in pelvis. Colostomy wound gives only moderate control	Only case reported in which inguinal glands showed involvement
Sacral route Resection from external sphincter to 1 inch above growth End to end anastomosis	Defecation through both ani Sutures tore and end retracted 2 inches Wound healed kindly by granulation	Discharged in 4 months Bowels moving equally by both paths No control Only small sinus leading to sacral end	Alive and well at present, 3½ years after operation Fair control through colostomy anus, the sacral wound and anus having closed spontaneously	Note long period of no recurrence after narrow margin of healthy gut resected, also failure of any function in retained anal sphincter
Sacral route Resection 3 inches of bowel without disturbing sphincter End to end sutured	Marked fecal fouling of wound, with sloughing and separation of line of union No general sepsis	Still in hospital 3 months after operation Has involuntary movements through both routes	No recurrence but local conditions only slowly improving	Note lack of union and fouling of wound because lateral colostomy does not deflect all feces
Sacral route Amputation of 6 inches of gut Proximal end sutured in upper angle wound	Good healing of wound, but constant soiling by feces	Discharged in 7 weeks with absolute incontinence	No recurrence at present, 5 months after operation, sinus persists, no control over defecation	Patient threatens suicide
Sacral route 5 inches amputated, end closed, and dropped into wound	Distal end open and bowels move through both ani Wound became fouled and suppurated rather freely This stopped after complete colostomy was performed 3 months later and healed There was moderate sepsis	Discharged after 6 months Sacral wound healed Colostomy wound giving very fair control, unless with diarrhea	At present, 9 months after radical operation, is in excellent health Very satisfactory control over inguinal anus	Note inadequacy of lateral colostomy and rapid healing after complete colostomy
Kraske Resection of 3½ inches of gut End to end suture Sphincter divided, but returned	Wound healed with moderate sepsis Some tearing of sutures	Discharged in 5 months with wound healed and fair fecal control	Remained in good condition for 2 years Then recurrence locally, died three years after radical operation	Condition gained markedly after colostomy
Perineal route Amputation of 6 inches of rectum Proximal end sutured in superior angle wound	Marked fouling of wound Separation and retraction of rectum Rather severe sepsis	Still in hospital 1 month after operation Incontinence Wound healing		
Sacral route Amputation of about 8 inches of gut Closure lower end of bowel	No infection in wound	Died on eighth day from general loss of strength Wound clean	Had very fair control over colostomy during 3 weeks after wound healed	
Perineal route Sphincter split, 6 inches excised Upper end brought down and sutured through sphincter Wound partly closed	Sutures in gut gave way Gut retracted 2 inches Wound became fouled and suppurated Wound ripened Severe sepsis resulted Wound healed rapidly by granulation after colostomy	Discharged with posterior wound nearly healed in 3 months Fair control over colostomy movements	Present time, 5 months after operation, in excellent health, working as engineer Colostomy after removing skin constriction a month ago gives excellent control over movement	Note failure of union of gut at skin margin, also rapid gain after colostomy
Sacral route Amputation of 6 inches of gut and posterior vaginal wall End left attached in depth of wound	Long course of chronic sepsis Wound healed slowly Marked gain in general condition	Discharged in 3 months, with posterior wound nearly healed except at upper margin where cervix uteri projects through	In good health at present after 11 months Colostomy gives very good control, permitting her to attend to household work without trouble Cervix still presenting in wound	Note good control in simple colostomy

than one, 5 cases, or 11 per cent (Two in this class may have died from intercurrent disease )

Died from recurrence in less than three years and more than two, 4 cases, or 9 per cent , and 2 cases in this period who are suffering from extensive recurrence with extreme cachexia, raising the probable per cent of recurrence death in this class to 13 per cent

Living more than 3 years 1 case 9 years, 8 months,  
1 case 4 years, 6 months, 2 cases 3 years, 6 months, 1 case  
3 years, 2 months A total of 5

Living less than 3 years and more than 2, 1 case

Living less than 2 years and more than 1, 1 case

Living less than 1 year, 8 cases

Estimating that one-fifth of these ten cases who have lived less than three years will reach that limit, there are 2 cases to add to the 5 already past that time Thus, 7 cases based on 44 (2 could not be traced) give the per cent of estimated cures at 16

The complete colostomy is a satisfactory method of preventing sepsis, and thus lowering the operative mortality

Done by the intermuscular method and beneath the rectus sheath, the colostomy gives a better control than does the impaired retained sphincter in most cases

For complete eradication of the disease, the rectum from above the growth to and including the anus must be sacrificed

An earlier diagnosis is possible in most cases and will tend to improvement of final results

# CONTUSION AND LACERATION OF THE MUCOUS AND ALAR LIGAMENTS AND SYNOVIAL FRINGES OF THE KNEE-JOINT

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THE following cases, which have come under the author's observation during the last two years, are reported because the conditions found are of interest in connection with some of the "chronic knees" observed clinically where no history or physical sign points to a lesion that could be detected without opening the joint

Before giving the histories in detail, it may be well to briefly call attention to the anatomical peculiarities of the structures involved. The accompanying semidiagram illustrates their position. Properly speaking, they are not ligaments, but folds of the synovial membrane containing a varying amount of fat. The mucous ligament is triangular and usually about one and one-quarter inches at the base, which is about opposite the middle of the ligamentum patellæ on the synovial membrane. The apex is attached in the intercondylar notch, and varies from a thread-like structure consisting of but two layers of synovial membrane to quite a dense and firm band with considerable fat. The thickness at the base is usually about one-eighth to one-quarter of an inch. The flat sides are superior and inferior, the position in the joint being nearly horizontal (Fig 1). The alar ligaments are two similar folds of synovial membrane extending from either end of the mucous ligament outward and then upward, skirting the margin of the patella, lying between the anterior edge of the articular portion of the condyle and extending to about the middle of the patella. These two folds, just as the mucous ligament, may consist solely of synovial membrane, or they may contain fat

and appear then irregular and lobulated. They are not symmetrical, as a rule, one side being more pronounced than the other. Their relation to the margin of the anterior articular surfaces of both condyles and to the patella exposes them to injury in any accident affecting the anterior part of the joint, and, inasmuch as their position in the joint corresponds to the two little triangular fossæ found on palpation of the joint at either side of the ligamentum patellæ and extending up along the patella, it will readily be seen how the conditions such as described in the following cases did arise (Fig 2). Besides these two structures there exists in some knees a transverse fringe along the line of the joint. This fold of synovial membrane corresponds in structure to the synovial folds already described and contains a varying amount of fat (Fig 3).

CASE I—M S, aged fifteen years, male, August 18, 1903. Seven months before entrance to the Lincoln Hospital "sprained" right knee. The knee swelled occasionally after exertion. While swollen, he has been obliged to "sit about" for a few days because of pain and a sense of weakness. The swelling never goes away entirely, though there is no discomfort in the intervals between the painful attacks. The history is otherwise negative. Comes to hospital towards end of attack. Physical examination is negative except for the right knee.

*Right Knee*—Considerable fluid, patella floats, normal fossæ obliterated, subcrural bursa prominent. Right knee over middle of patella one and one-half inches larger than left. Slight limitation of motion. Fluid in joint not under much tension. Slight tenderness in region of patellar ligament and along inner side of joint line. Active and passive motion not painful. Slight lateral motion, more than on left side. No inflammatory sign. Limp.

*Operation*—Curved incision from ligamentum patellæ side-wise over joint line four inches. Fluid in joint light brown. Alar ligament injected, swollen, under patellar ligament a free jagged fringe projection into joint. Semilunar cartilage, coronary ligament, and anterior crucial normal.

*Diagnosis*—Old rupture of ligamentum mucosum, contusions of alar ligament and transverse synovial fringe.

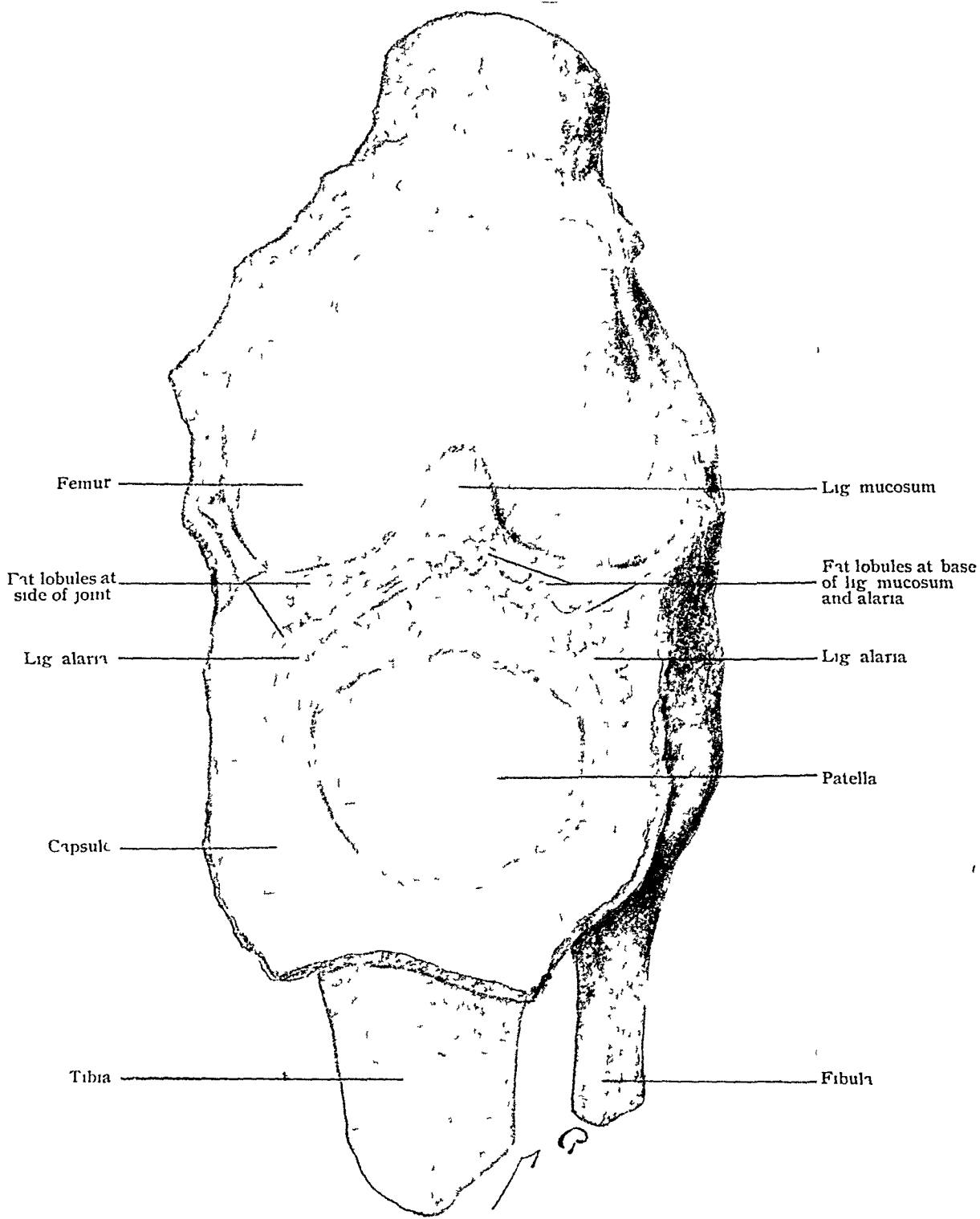


FIG 1 —Normal joint Patella turned down



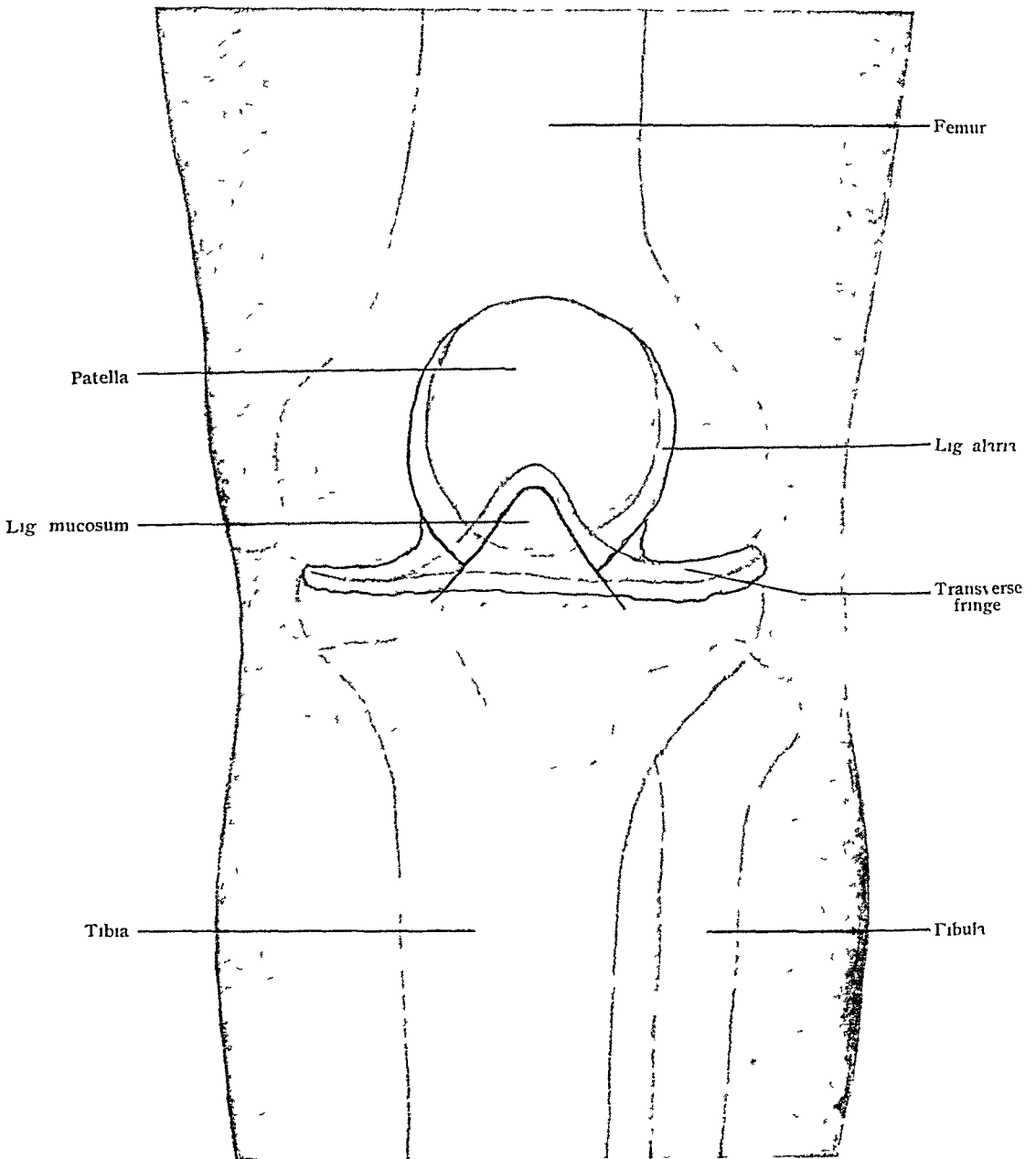


FIG 2 —Diagram of position of synovial ligaments

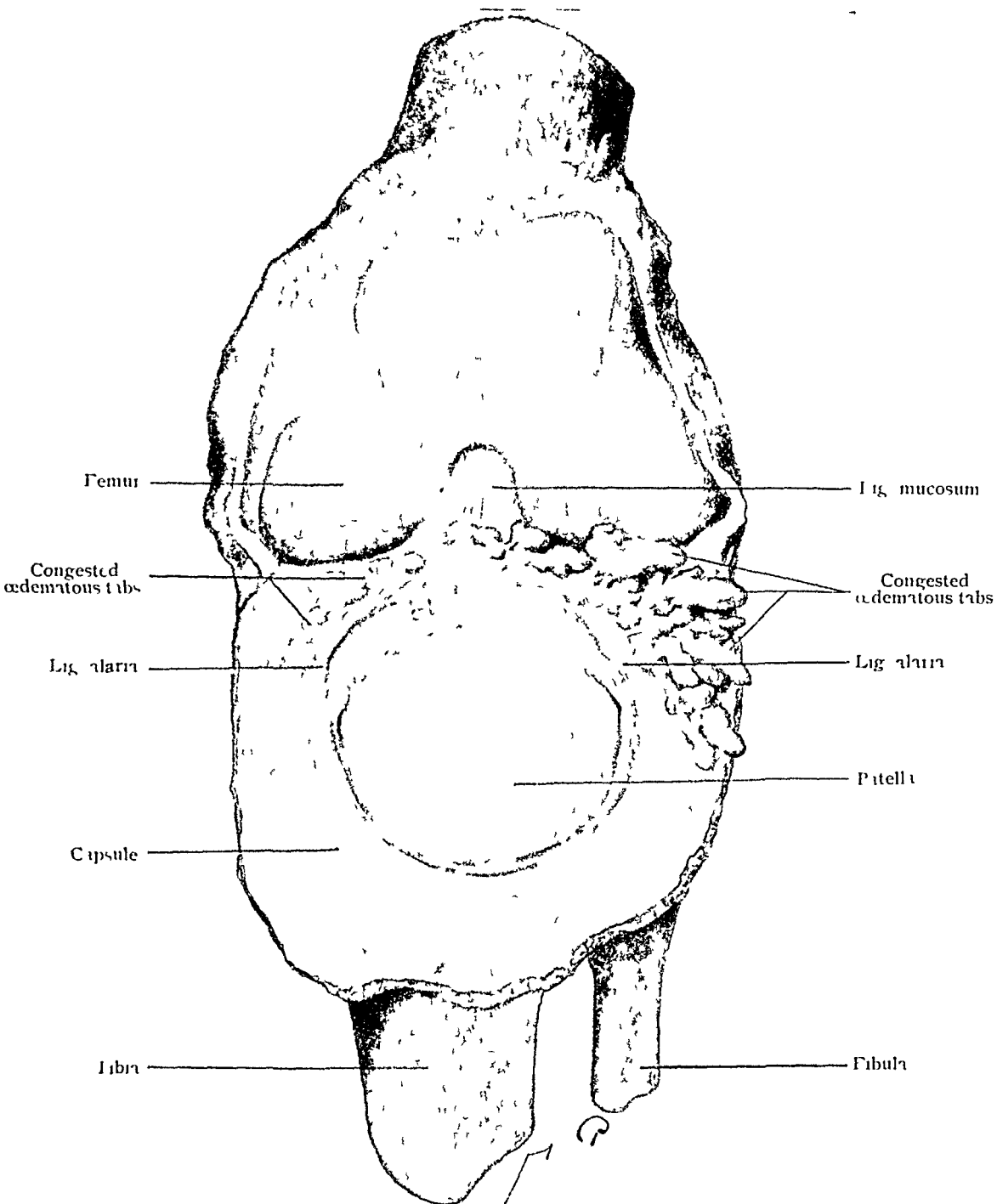


FIG 3—Schematic diagram of appearance of chronically irritated infiltrated fat folds and joint hinges

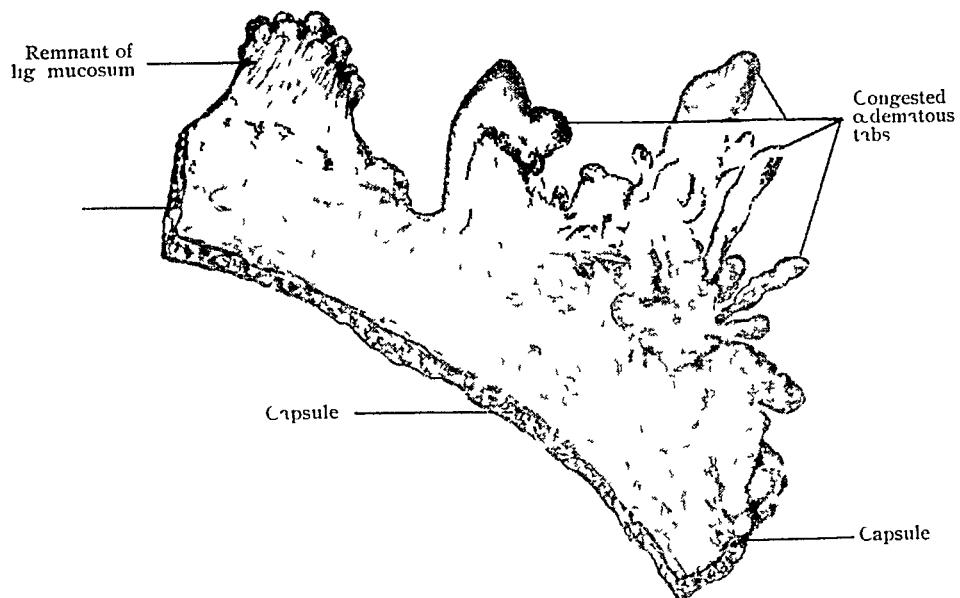


FIG. 4—Specimen from Case IV

Ligamentum mucosum and inner alar ligament excised with piece of capsule Joint washed Capsule closed with continuous fine catgut Fascia with continuous chromic gut Skin, continuous silk Small rubber tissue-skin drain Dry dressing, plaster of Paris

Temperature before operation, 98° to 99° F Day after operation, 102 4° F , next day, 100 5° F , then normal

Four days after operation wound examined Some fluid in joint Aspirated, fluid pale pink, pressure dressing Did not fill up again Primary healing Walked on twenty-first day Discharged on twenty-ninth Examined nine months after operation

Right knee one-half inch larger than left, no excess of fluid Patella does not float, no point of tenderness Has had no recurrence of old "swelling" No limitation of motion No bulging of scar region No limp

Pathological report of excised tissue "Chronic inflammatory" (Fig 4)

CASE II—J J, aged thirty-three years, male, October 5, 1903 Six weeks before entrance fell from bicycle Knee swelled one-quarter of an hour after injury Stayed in bed two weeks, knee then reduced to normal size Since then has been about his work, but at times has a sharp "catch" on outer side of knee, following which there is some local tenderness for a few days Has not noticed any swelling Has not stopped work until yesterday, because of an attack more severe than the average Physical examination negative except for one point of tenderness to outer side of patellar tendon, slight swelling here No fluid in joint made out On flexing and extending knee with thumbs at either side of patellar tendon something is felt to slide beneath the thumb over the outer side Slight limitation of flexion and extension No inflammatory signs The sliding object was erroneously considered to be a loose meniscus

*Operation*—Curved incision from ligamentum patellæ outward No excess of fluid in joint Semilunar cartilage normal, also coronary ligaments From beneath ligamentum patellæ outward is an irregular fringe, in places one-half inch broad by one and one-half inches long, with irregular nodular tabs, slightly injected, slips backward and forward on flexing and extending the leg This represents the mass mistaken for a loose cartilage

Fringe excised with a piece of capsule Capsule closed with fine continuous catgut, fascia with continuous chromic gut, skin with silk Plaster of Paris Temperature after operation, 101 2° F on first day, 102 4° F on second, then in course of three days to normal Per primary union Fluid did not accumulate in joint Walked on fourteenth day, discharged on twentieth

*Diagnosis*—Contusion and laceration of alar ligament and synovial fringe

*Pathological Examination*—Tuberculosis

An effort to locate the patient six months later failed

CASE III—J A, aged twenty-seven years, male, January 16, 1904 Five and one-half weeks ago fell while catching horse Right knee swelled immediately, walked home In bed two days, then to hospital Treated with plaster of Paris three weeks and then splinted Swelling has remained the same since first treated

On examination, knee distended, tense Contour sharply outlined Normal depressions felt, patella floats Flexion 15 degrees less than on left side Extension 10 degrees less than on uninjured side Circumference one and three-quarters inches greater over middle of patella No inflammatory sign or symptoms Walks lame Tenderness along line of joint at both sides of ligamentum patellæ, more so on inner side

*Operation*—Vertical incision along inner side of patella Joint contains thick, syrupy, dark-brown fluid Semilunar cartilage, coronary and anterior crucial ligaments normal The synovial fringes along anterior aspect of joint, alar, and mucous ligaments are thickened and project into joint The adjoining synovia is also injected Fringes removed, joint closed after washing Per primary healing Allowed to walk on tenth day Return of swelling, bed, splint, aspirated, fluid pale On twenty-first day no swelling left, twenty-eighth day walks and discharged from hospital Seen two weeks later, no fluid in joint, but favors this leg, and walks with slight limp, although no pain, and can attend to duties

*Pathological Examination*—"Chronic inflammatory"

*Diagnosis*—Contusion of alar ligament with secondary changes

Seen again at the end of thirteen months The limp had gone, but still avoided complete extension of leg No subjective signs

CASE IV —A P, aged forty-seven years, female, September 6, 1904 Two months ago fell from chair and wrenched knee Knee swelled at the time for about two weeks Painful area along outer side of joint No limit of motion Swelling went except for a small area corresponding to the painful region The knee had been strapped, but no improvement When sitting, there is no pain, but after keeping quiet for some time knee seems stiff and painful when attempting to walk Walking and going up and down stairs most painful Sensation of something slipping beneath finger in swollen region

*Operation* —Incision outer side of joint through the swollen area Very little clear fluid in joint Synovia under swollen regions injected, and also alar ligament over an area of about one-half by three-quarters of an inch reddened and much larger than in adjoining region Mucous ligament is free in joint with thickened jagged margin On flexing and extending leg, this reddened area comes to be between outer margin of patella and condyle of femur, and corresponds to the mass felt to slip beneath the finger before operation

*Diagnosis* —Laceration of mucous ligament, contusion of alar folds Joint closed, bed for three weeks, per primam healing No accumulation of fluid after operation Temperature, 101° F on first day, then normal Walked on twenty-second day

Seen four months after operation Has had no return of discomfort, no fluid in joint Joint crepitus is still more than on opposite side, and there is very slight limitation of extension, no subjective signs

Of the knees that happen to come under the author's care, these were chosen for operation because there was a recent history of injury combined with subsequent conservative care without beneficial result

It is a common thing to see abnormal knees with and without effusion A diagnosis of the nature of the trouble is often impossible The condition is termed chronic synovitis or is explained as being due to rheumatism, rheumatoid arthritis, or is called simply "chronic knee" The exact etiology cannot be determined In a certain number of these cases there is a distinct history of trauma, with a subsequent history of con-

tinuous or intermittent discomfort which progressed slowly with years

It is this group with an early history of trauma which led me to select the class of cases above referred to for interference, in the hope that, by an early operation after short and unsuccessful treatment, some lesion might be found which would account for the lack of response to such care, and for the subsequent impairment of function. By removing this source of trouble, one might prevent the progress of a process which would finally become chronic, and thereby limit the number of knees which later are so evidently beyond the sphere of surgical interference.

It is not usual to operate upon traumatic knees in the early stages unless there is the possibility of making a fairly accurate diagnosis. One feels justified in entering the abdominal cavity for exploratory purposes on very slight provocation because of the improvement in our operative technique, and because we are supported by the knowledge that the peritoneum is well able to take care of a wide margin of error on our part.

It is not so with the knee-joint, although the knee will defend itself to a moderate extent, as shown by the cases of mild infection which recover after no other interference than aspiration. Still, its powers of recuperation cannot be compared with those of the peritoneum, and the disastrous result of an infected knee is painfully impressed upon the mind of all except the most fortunate surgeons. There is another reason, also, why we do not care to risk operating on the knee for exploratory purposes. An individual with an infected peritoneum does one of two things,—he either gets well and does not show much evidence of what he has been through, or he dies. The man with an infected knee does the same,—he recovers or he dies. The calamity of the fatal cases is equally great, but the recoveries differ, the man recovering from an infected knee is apt to have a stiff joint or have had an amputation,—memoranda at all times connected in the individual's mind, throughout his life, with the unfortunate surgeon's name and skill.

For these reasons, no man who is not trained daily in surgical procedures and who does not make every effort to keep his technique as perfect as possible, is justified in opening the knee-joint. Granted these essentials, we may interfere in cases where the diagnosis is less certain, in the hope that the benefit will be sufficiently great to offset the risk.

The four cases above referred to—operated upon for exploratory reasons—were selected cases. An absolute diagnosis was not possible, but it was highly probable that some lesion would be found,—a supposition justified as subsequent conditions proved. The number is too small to draw conclusions from except for individual cases.

All four cases had two apparent subjective symptoms,—pain and limitation of function. In all four these two symptoms were relieved for the time. It is not possible to say what the permanent result will be, but in two of the cases one and one-half years and one year have passed without return of the symptoms.

Of the objective signs, there was a varying degree of effusion in all four cases, limitation of motion in three, and some increase of joint crepitus in one. The effusion disappeared in all, the limitation of motion was entirely overcome in one; in one it persisted and one could not be subjected to a late examination. The case with joint crepitus still had joint crepitus after six months, but not as marked. In all four cases there were before operation symptoms which intermittently or continually interfered with the individual's daily duties. In the three cases which could be examined at a later date there had been no recurrence of these symptoms. One patient still had a slight limp, which was not painful. Passive motion was perfect. No reasonable explanation was found.

Although the subjective signs which interfered with the duties of life were relieved, two of the three seen at a later date complained "that at times they did not feel quite as strong as the other side."

It is therefore evident that in the above four cases the greatest improvement was in the subjective signs, and that



certain objective symptoms remained, which, however, did not interfere with the function of the member

It will be noted that in Case II the pathological report showed tuberculosis. The process was fresh, well marked, and active. Macroscopically, the writer could see no great difference in the appearance of the various synovial fringes excised, with the exception that in the specimen from Case II the entire region was much more vascular, whereas in the other three the fringes appeared pale, oedematous, with hæmorrhagic areas evidently the seat of recent insult. Whether in Case II a pre-existing tuberculous condition was injured, or whether an injured synovial fringe had become tuberculous, is a matter that could not be decided because of the absence of facts justifying an opinion one way or the other. There was no evidence of bone disease, but, considering the etiological importance of trauma in tuberculosis, combined with the fact that synovial membranes elsewhere in the body may be the seat of primary tuberculosis, and that it is not uncommon to find on operation extensive villous tuberculosis of the entire knee-joint synovia without any sign of bone disease, it would seem hard to conclude that a bruised knee-joint fringe might not occasionally be the locus minoris resistentiæ for tuberculosis.

It is my opinion that every traumatic knee showing localized tenderness with effusion into the knee-joint should be aspirated, provided there is not a marked diminution in the amount of effusion under treatment at the end of one week. Should the condition be a hæmarthrosis, it is better to make a small incision and wash the joint clean. The thick fluid and possibly clots do not run out well through a trocar. Fluid, if allowed to stay in the joint too long, does harm in two directions. First, the capsule and ligaments become chronically distended and lax, interfering with the stability of the joint and paving the way to permanent alteration of the joint structures. Secondly, the contained fibrin, according to König, becomes deposited on the wall of the joint, or floats free in the joint, covers with epithelium, and so gives rise to foreign bodies in the joint. Should fluid reaccumulate after aspiration,

it must be drawn off again After a hæmarthrosis has been emptied by open incision, the joint will at times fill again This second fluid can generally be removed by aspiration, not being as thick as the first

As far as the injured synovial ligaments are concerned, if repair should always take place without leaving subjective or objective symptoms, there would be no reason to connect the injury with the etiology of "chronic knees," and therefore no reason for interference

Such is unfortunately not the case Not only do case histories like the above four illustrate that complete restitution ad integrum does not always occur, but joints opened after much greater lapse of time since an injury, for some reason or other, show conditions of the synovial ligaments that could readily be explained as being of traumatic origin primarily The crushed, torn, and infiltrated alar and mucous ligaments act as foreign bodies in the joint, are perpetually being injured, giving rise to pain and repeated attacks of effusion with the secondary results The joint is chronically irritated by mechanical interference, and gradually undergoes such secondary changes as give rise to chronic effusion, relaxed ligaments, increased lateral motion, intermittent pain, changes in cartilage, synovial membrane, etc At times these injured ends of the synovial membranes become completely separated, and are therefore one of the causes of foreign bodies They may also be found firm, almost cartilaginous, a change possibly due to trauma primarily Cases where the offending piece of tissue has clinically all the signs and symptoms of a free floating body, and yet still connected by one or more bands with the original seat, are not uncommon It is for these reasons that we conclude that if, on walking about, fluid reaccumulates and tenderness and pain reappear at intervals after four or six weeks of conservative treatment, the patient should have the conditions connected with an operation explained to him, for it would seem, judging from the cases above cited, that an early operation for such bruised and lacerated synovial ligaments of the knee-joint will give the patient in some cases

complete subjective relief, combined with a varying degree of objective improvement, besides diminishing in all probability his chances of becoming at some future date a victim of a so-called "chronic joint"

As Case II shows, it may occasionally happen that one stumbles upon a very early tuberculous lesion, the removal of which representing an advantage hardly necessary to emphasize

Far be it, very far be it, from my intention to recommend promiscuous exploration of the knee. For reasons apparent to every surgeon, it might not be unjust to conclude that any diminution of fear of opening the joint would be followed by a corresponding increase in the number of calamities

It is, however, the writer's opinion that there are many knees not operated at the present time which should be opened because of the benefit to be derived. One class of such knees is composed of traumatic cases that, after judicious and properly applied conservative care, still show signs representing conditions which, if allowed to persist, will surely lead to secondary changes and symptoms such as we are perpetually finding in patients afflicted with the so-called "chronic knee." For example, should there be, after injury to a knee, local pain, effusion into the joint, local swelling, with or without other subjective and objective signs, and should, in spite of rational conservative care, these symptoms persist or reappear after cessation of treatment, then the knee should be opened while the seat of trouble can be recognized and before serious secondary changes have occurred

# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY.

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*Stated Meeting, April 12, 1905*

The President, HOWARD LILIENTHAL, M D , in the Chair

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### ENORMOUS SARCOMA OF BREAST

DR HOWARD LILIENTHAL presented a woman, aged twenty-nine years, who was admitted to Mt Sinai Hospital on February 24, 1905. About six years before her admission she first noticed a small, painless mass, about the size of a marble, in the right breast. This mass rapidly grew in size, especially during the year prior to her admission. There had been no loss of flesh or strength.

On admission, a mass was found involving the whole right breast. It was about the size of an adult head. Its surface was nodular because of the presence of projecting lobules, some of which felt soft, others hard. The tissue between the lobules felt cystic in some places, firm in others. The tumor was adherent to the overlying skin, which was of a bluish-red color, and contained many dilated veins. The whole mass was attached to the breast by a flat pedicle, six inches wide and three-quarters of an inch in thickness. A few small, soft glands were felt in the right axilla. The left breast was normal.

On March 1, 1905, a radical amputation of the breast was done, the pectoral muscles being removed and the right axilla cleaned out. The mass at the time of its removal weighed seven and one-half pounds. The operation was attended by an unusual amount of hæmorrhage, which might be expected in the removal of a growth of such dimensions. The pathologist,

Dr F S Mandlebaum, pronounced it a myxosarcoma, with cystic degeneration. The patient made an uninterrupted convalescence, and was discharged eighteen days after the operation.

### URETERAL CALCULUS, TWO CASES

DR JOHN F ERDMANN presented a man, twenty-nine years old, who first came under his observation on the first day of March, 1905. He gave a history of having had a pain in the right side for three or four years. The pain was paroxysmal in character, and at times uncontrollable. His last attack had occurred about five weeks before, and had necessitated his going to bed for twenty-four hours. At no time had he been bedridden for a longer period than this. Vomiting sometimes occurred during the attacks, and he also stated that they had been accompanied by jaundice of the face. He complained of pain in the region of the right kidney and extending down towards the bladder. At the time of voiding urine he would have a peculiar pain in the bladder, but there were no symptoms pointing to the genital organs. He was constipated, and also complained of pain in the region of the appendix.

Examination of the abdomen did not give any pronounced evidences upon palpation. In fact, there was no sensitive spot on pressure anywhere over the body. A tentative diagnosis of ureteral stone was made. The patient was X-rayed by Dr Caldwell, and the plate showed a large shadow midway between the spine of the ischium and the sacro-iliac synchondrosis, in the region of the right ureter. The shadow was seven-eighths of an inch long, seven-sixteenths of an inch wide at its widest point, and shaped like an olive pit.

Operation, March 11, 1905. An incision was made beginning at the inner portion of the right rectus muscle, and extending outward with a very slight curve to and above the anterior superior spine of the ilium. The peritoneum was accidentally punctured, and feeling that no harm could be done by making a transperitoneal examination, and that thereby the operation could be more rapidly terminated, the opening in the peritoneum was enlarged. Through this opening the stone was readily palpated. Before dissecting back the peritoneum for a retroperitoneal operation, the appendix, which was found to be adherent and sclerosed, and showed evidence of earlier disease, was re-

moved The peritoneum was then dissected up and the ureter exposed By keeping two fingers within the peritoneal cavity, Dr Erdmann said he was able to hold the stone in such a position that incision of the ureter retroperitoneally was readily accomplished The stone was extruded through a longitudinal incision which was closed with silk sutures, the peritoneal wound was closed, and a cigarette drain was placed behind the peritoneum down to the site of the ureteral wound The abdominal wound was closed, with the exception of the site of the retroperitoneal drain The patient made a perfect recovery, and left the hospital on the fourteenth day The urine, which was bloody on the first and second days, cleared up on the third The patient had not complained of any of his former urinary difficulty since the operation

DR ERDMANN presented, also, a man, twenty-three years old, who stated that six months ago he had a pain in his abdomen extending well into the back He had had several attacks of pain resembling that of appendicitis, necessitating his remaining in bed for anywhere from one to four days at a time Three days ago he had an attack which was ushered in by vomiting and pain in the abdomen He also complained of pain in the right side of his back This last attack had kept him in bed for two days He had suffered continuous pain from twelve at night to early morning of the following day He also had attacks of pain that would manifest themselves in the glans penis, but not in the testes

Upon examination, the abdomen was found to be extremely sensitive in the high appendicular region, and there was also pain by bimanual examination over the right kidney The patient was X-rayed twice, four plates being taken In one of these, a small shadow located at a point opposite the ischial spine in the pelvis was taken for a stone in the ureter, but the physical signs and the urine analysis tended to negative that diagnosis An incision similar to that employed in the preceding case was made The skin was retracted in the course of the rectus, and the anterior layer of the sheath of the rectus was cut in the line of the skin incision, so that a separation of the muscle fibres of the abdominal wall could be produced The peritoneum and deep fascia were cut in the axis of the rectus Exploration revealed a hard nodule, like a gland, within an inch of the bladder wall

The appendix was congested and bound by numerous adhesions. The pelvic peritoneum was loosened from the deeper structures and the ureter exposed. It was then seen that the small, hard body was a calculus of the ureter, within an inch of its bladder orifice. The ureter was incised in its long axis and the stone extruded. The ureteral opening was then closed with silk, the peritoneum dropped back, the appendix removed, and the peritoneal wound closed after the kidney had been palpated, with negative results. A drain was then put down to the incision in the ureter, and the external wound completely closed, with the exception of the point of the drain. The operation occupied about forty minutes. The stone was seven-sixteenths of an inch long, five-sixteenths of an inch at its widest point, and three-sixteenths of an inch thick. It was of an irregular mulberry shape.

#### TETANUS FOLLOWING INTERVAL OPERATION FOR APPENDICITIS, WITH ASEPTIC HEALING OF WOUND

DR. WILLY MEYER presented a man, twenty-seven years old, who was admitted to the German Hospital on January 21, 1905. Seven weeks before he had an attack of appendicitis, characterized by chills, fever, and pain in the right side of the abdomen.

A week ago he again had an attack of pain in the region of McBurney's point, accompanied by chills and fever. There was no vomiting. Since the onset of the attack his pain had grown worse, and he also complained of severe frontal headache. His appetite was poor, the bowels constipated.

Examination showed a well-developed man, whose general condition was good. There was no dyspnoea nor jaundice. There were a few herpes on the upper lip. Lungs and heart negative. The abdomen was not distended. There was slight tenderness in the right iliac region, and pressure over McBurney's point elicited some pain. No mass could be felt. The liver and spleen were not palpable. A rectal examination was negative. The patient's temperature on admission was 105.4° F, pulse, 128, respirations, 28.

Operation, February 2, 1905. The appendix was removed by the rectus incision. It was covered by adhesions, and somewhat injected. The stump of the appendix was inverted by purse-string suture covered with three Lembert sutures. The abdomen

was closed in layers The wound healed by primary union, and the silkworm-skin sutures were removed on February 9

On February 12 the patient complained of some inability to open his mouth, and on the following day he had a marked spasm of the masseter muscles on both sides The teeth could only be slightly opened, and the patient complained of pain on both sides of the jaw A 3 per cent carbolic acid solution was injected every two hours On February 14 the trismus was more marked There was slight rigidity of the neck muscles and pain in the back of the neck The eyebrows were elevated, due to contraction of the orbicularis Risus sardonicus was noticeable The abdomen was rigid On this day, intraspinal injections of antitoxin serum were begun by Dr Meyer On the following day the patient was able to open his mouth about 3 centimetres The abdomen was still rigid There was marked spasm of the muscles and some pain on pressure over the abdominal scar Three days later the patient had a clonic spasm lasting three minutes On the following morning he had two similar convulsions, lasting three and four minutes respectively Assumed an opisthotonos position Trismus was marked There was great pain in the neck and considerable dysphagia He could not retain nourishment per os, and rectal feeding was begun

On February 21 the patient's condition was improved The spasm of the neck muscles and the opisthotonos had entirely disappeared, but he still complained of a little pain in the neck Trismus was not so intense He took plenty of nourishment per os He continued to improve, and on March 11 he was able to open his mouth so that three fingers could be admitted There was still some spasm of the masseter muscles, but the abdominal rigidity was less marked On March 15 he stated that he felt perfectly well Trismus and the rigidity of the abdominal muscles had disappeared, and he had no more pain

During the course of his illness, the patient had received four intraspinal antitoxin injections between February 14 and 17, the dose ranging from 5 to 15 cubic centimetres Between February 15 and 21 he also received seven subcutaneous antitoxin injections, of 10 cubic centimetres each Between February 14 and March 16 he was also given hypodermic injections of a 3 per cent solution of carbolic acid, a syringe-ful every two hours He



also received per rectum, from February 14 to 17, 30 of chloral hydrate in solution every four hours

On February 19 blood cultures made from a small amount of serum collected below the sutured skin of the appendectomy wound gave a negative result

Dr Meyer said he had looked up the literature on this subject. In one of the most recent articles by Lanz and Javel there is a report of a pathological examination of 8 normal appendices and 138 diseased ones. In every instance in which the normal appendix was examined, quite a number of species of bacilli were found, especially the colon bacillus, then the bacillus of malignant œdema, and the pseudotetanus bacillus. In 10 per cent of the 138 inflamed appendices, the result of the pathological examination was negative, showing sterility of organ, probably due to the work of the leucocytes. Dr Meyer said the only explanation he could offer for the development of the tetanus in this case was that either the true or pseudotetanus bacillus was present in the appendix, and handling the organ caused the absorption of the micro-organism from the intestinal tract.

#### CARCINOMA OF THE MALE BREAST

DR WILLY MEYER presented a man, forty-six years old, who had been operated on in July, 1903, for carcinoma of the left breast. The radical operation was done as devised by Dr Meyer ten years ago. The skin incision, as employed during the last seven years, commenced at the insertion of the pectoralis major tendon, passed about one inch and a half above its axillary border, and swept around the breast, forming two large flaps, an upper and a lower, ending beyond the middle of the sternum. By his method, one worked towards the sternum instead of away from it, and the entire pectoralis major was removed. By cutting the tendon of that muscle at the outset, one had, of course, to remove the entire belly of the pectoralis major, and gained immediate access to the main vessels feeding the breast. Immediate skin grafting was always resorted to.

Up to the present time, this patient showed no signs of a recurrence, and the functional result, so far as motion in the arm was concerned, was perfect. There was some œdema of the forearm.

DR LILIENTHAL said the method of operation described by

Dr Meyer had also been followed in the case of enormous sarcoma of the breast that he had shown, and excellent motion of the arm had resulted

### STRANGULATED UMBILICAL HERNIA

DR JOSEPH A BLAKE said that during the past winter he had operated on four cases of strangulated umbilical hernia, and one case of strangulated relapsed umbilical hernia, all occurring in his service at the Roosevelt Hospital, a remarkable number for so short a period, considering the rarity of the condition

One patient, a woman fifty-one years of age, was in such an advanced stage of chronic nephritis, emphysema, and mitral disease, that she could not lie down, and was operated upon in a half-reclining position under Schleich infiltration anæsthesia

Owing probably to the diminished vitality of her tissues, suppuration occurred about the chromicized gut sutures in the depth of the wound, and extended to the peritoneum, causing her death on the tenth day after operation The remaining cases, which recovered, were as follows

CASE I—L M, a woman forty-one years of age, was admitted on November 21, 1904 She had been operated upon three years previously for an umbilical hernia A relapse had been noted for a year and a half Six days before admission, symptoms of strangulation had appeared, and continued without remission up to admission

The patient's weight was estimated to be between 250 and 300 pounds Examination revealed a very large protrusion in the region of the umbilicus, measuring nine inches in a vertical by fourteen inches in a horizontal direction The mass was tense and sensitive, the skin was reddened in places, and distinct gaseous crepitation was evident, fever was present, the pulse was 116 and rather feeble

Under nitrous oxide and ether anæsthesia, a transverse elliptical incision, six by fifteen inches, was made, and the sac opened The contents consisted of the transverse colon and great omentum, and running in and out, in an indescribable manner, through the latter and between bands of scar tissue which in places was half an inch thick, was a loop of small intestine, distended and necrotic in several places The mere freeing of this loop took nearly an hour

Sixteen inches or more of this loop were resected and the ends joined by suture. The major part of the omentum was removed with the sac, the remainder being used to help close the aperture, a radical operation being impossible.

The patient developed severe asthma after the operation, so that for four days she had to sit up in order to breathe, and her condition was very precarious. This subsided under antispasmodics and cupping, and she eventually made a good recovery, being discharged cured on the forty-fourth day.

CASE II—K R., a woman of fifty-five years, was admitted on the same night as the previous patient. She had had a small reducible umbilical hernia for five years.

Three days before admission, she had had an attack of severe pain in the hernia, which became irreducible. The bowels had acted on the following day, after taking castor oil, and again on the next day, spontaneously. She had not vomited.

Operation was delayed for thirty-six hours on account of the absence of signs of obstruction and was then performed on account of the increasing signs of inflammation of the hernia. A probable diagnosis of a partial enterocele (Richter's hernia) was made. Operation revealed this to be the case, less than half the circumference of the bowel having been caught and strangulated, resulting in necrosis of an area of about the size of a quarter of a dollar. There was no omentum in the sac. The necrotic area was infolded by a few Lembert stitches, and the gut was dropped back into the peritoneal cavity. The abdominal wall was repaired by lapping from above downward, according to Mayo's method. Recovery was uneventful.

CASE III—B McL., a woman fifty-seven years of age, was admitted on February 15, 1905. She had had an irreducible umbilical hernia for fifteen years, which had gradually increased in size to that of a child's head. There had been repeated attacks of obstruction, which had been relieved by cathartics.

For three days before admission there had been symptoms of strangulation, persistent vomiting, complete obstipation, distention, and rapid increase in the size of the tumor to that of a foot-ball.

On admission she was markedly prostrated, the heart's action was rapid and feeble, there were sonorous and sibilant râles over both lungs. The hernia was tense, tender, and irre-

ducible, the skin was reddened, tympany was present, and gurgling was elicited

Under nitrous oxide and ether anæsthesia, a transverse elliptical incision was made, and the sac opened. The contents consisted of omentum and small intestine.

The latter was devitalized in many places from pressure from the bands and septa in the sac. It was also widely adherent. After it was freed its condition was so questionable, that, although it was not distinctly gangrenous, it was decided to excise the entire loop. This was done, forty-eight inches being removed, and the ends were united by suture.

Radical cure by the vertical lapping method was done. The patient made a good recovery.

CASE IV—B M, a woman fifty-one years of age, was admitted on March 15, 1905. During the six months preceding her admission, she had had several attacks of pain situated in the umbilical region, which were accompanied by vomiting. No hernia had been discovered. The attacks had all been transitory.

Four days before admission she had a similar attack, excepting that the vomiting persisted, and obstipation was complete. Examination revealed a very small umbilical hernia, almost hidden in the fat of the abdominal parietes. It was tender and the skin was somewhat discolored.

Under nitrous oxide and ether anæsthesia, a transverse elliptical incision was made, the small sac was opened, and a short loop of gut was found, strangulated but viable. It was reduced. The sac did not contain any omentum.

A radical cure by the Mayo method of vertical lapping was performed. Recovery was uneventful.

In summing up, Dr. Blake said that he preferred the operation of vertical lapping in cases where time was a factor, and in cases in which the diastasis of the recti was not marked. When diastasis was marked and the abdominal walls were loose and flaccid, he preferred transverse lapping. In all cases of intestinal resection, particularly in asthmatic patients, he preferred suture to union by mechanical aids.

DR. LILIENTHAL said that in one of Dr. Blake's cases, the second one he had reported, an area of necrosis about the size of a silver quarter was infolded by a few Lembert's stitches and the gut was dropped back into the peritoneal cavity. The speaker

asked Dr Blake whether he considered this a safe procedure? In most of those cases where there was a suspicious gangrenous area, the process was likely to have extended beyond the actual limits of the lesion, and he thought a liberal resection would be the safer method

DR BLAKE, in reply to Dr Lilienthal, said that in the case referred to, the small necrotic area was on the opposite side of the mesentery, and the strangulation only involving that side of the gut, the circulation in the rest of the gut was unimpaired

### RUPTURE OF THE SMALL INTESTINE

DR JOSEPH A BLAKE presented a man, thirty-eight years of age, upon whose back a heavy bureau had fallen, knocking him to the floor, so that he struck upon his abdomen

He immediately experienced a severe pain across the back, and vomited. He was, however, able to walk home, a short distance away. On reaching home the pain became abdominal and was very severe. There was persistent vomiting and obstipation. Fifteen hours after the injury he was admitted to the Roosevelt Hospital, with all the signs of a diffuse peritonitis. His temperature was 101.6° F, pulse, 112, respirations, 48.

Operation was performed two hours after admission, seventeen hours having elapsed since the injury.

A well-marked seropurulent general peritonitis was present. Twelve inches from the ileocolic junction the ileum was contused, and in the centre of the contusion there was an aperture five-sixteenths of an inch in diameter, from which the intestinal contents were exuding.

The area was inverted by means of Lembert stitches, the peritoneal cavity thoroughly washed out and closed, a short cigarette drain having been introduced, reaching barely into the peritoneal cavity. The wound was repaired by a tier suture. Infection occurred in some of the skin sutures, and on the ninth day the patient, who had developed bronchitis, burst the superficial part of the wound open in a fit of coughing, otherwise, convalescence was uneventful.

### SPLENECTOMY

DR JOHN A HARTWELL presented a boy, aged twelve years, who was admitted to the Lincoln Hospital on March 1, 1905

The history obtained was that he had fallen about fifteen feet, striking directly on his left side on a piece of timber. He suffered considerable local pain, but was able to walk home, where he was seen by a physician. On the following day he was so much better that the physician was notified not to call, but on the third day the doctor was again called because the boy complained of considerable pain in the abdomen, rather localized on the left side. It was aggravated by pressure and deep breathing. The boy had vomited once.

The patient's temperature on admission, forty-six hours after injury, was 100° F, pulse, 88, respirations, 24. He was poorly nourished and somewhat anæmic. The respiration was thoracic in character. There was some abdominal distention, with generalized pain and rigidity, but more marked over the upper left quadrant. In the left lumbar region, at the costal margin, a mass was palpable. It was very tender. There was also pain on pressure over the lower four or five ribs. The child was most comfortable when lying on his back, with his legs drawn up. The leucocytosis was 20,000.

*Operation*—An exploratory incision, two-and-a-half inches long, was made parallel with the outer border of the left rectus, beginning at the costal margin. The peritoneum was opened, and its cavity found to contain free blood. The wound was thereupon enlarged by a transverse incision outward, and the spleen brought into view. After removing the adherent omentum, a fracture of the spleen, penetrating one-third the organic thickness through the hilus, was found. The splenic vessels were caught in a single large clamp, and tied, and the spleen was then removed, leaving the clamp *in situ*. The abdominal cavity was repeatedly washed out with saline solution, and, as the fluid continued to return blood-stained, a further examination was made, which revealed a rent in the posterior abdominal wall and a slight laceration of the left lobe of the liver. This was checked by packing with gauze. The wound was closed in the usual manner, leaving the clamp on the splenic vessels undisturbed.

When the clamp was removed on March 6, five days after the operation, there was no hæmorrhage. The patient's recovery was uneventful, with the exception of a slight phlebitis of the left femoral vein, which developed on March 30.

Dr Hartwell said the following blood counts were of inter-

est in connection with the case On March 3, two days after the operation, there were 3,720,000 red blood-cells, 27,000 white cells, and 90 per cent hæmoglobin Polynuclears, 85 5 per cent , mononuclears, 9 per cent , lymphocytes, 5 per cent , basophiles, 0 5 per cent On March 7, red cells, 4,400,000, hæmoglobin, 95 per cent , white cells, 24,000, polynuclear, 92 per cent , mononuclears, 4 per cent , lymphocytes, 3 per cent , eosinophiles, 5 per cent , basophiles, 5 per cent On March 16 there were 4,100,000 red blood-cells, 18,000 white cells, and 95 per cent of hæmoglobin Polynuclears, 82 per cent , mononuclears, 12 per cent , lymphocytes, 5 5 per cent , eosinophiles, 0 5 per cent On April 12 the red blood-cells numbered 5,244,000, the white cells, 24,000, hæmoglobin, 90 per cent, polynuclears, 62 per cent , lymphocytes, 24 per cent , mononuclears, 12 per cent , eosinophiles, 1 per cent , basophiles, 1 per cent , no normoblasts nor poikilocytes were found The red cells were normal in size, and well colored The presence of suppuration in the wound around the clamp and drain probably had some effect on the leucocytosis, though this was 20,000 prior to operation

In presenting this patient, Dr Hartwell raised the query whether in a case of this kind, which was in such good condition at the end of forty-eight hours, it was better to operate as he had done, or treat the case expectantly, with the hope that the bleeding would cease spontaneously, as was recommended by some authorities?

DR BENJAMIN T TILTON thought that in cases of suspected laceration or rupture of the spleen, it was advisable to make an exploratory incision, and act according to the condition met with Unless the abdomen was opened, one could never tell how severe the injury was He recalled one case where a man, after an abdominal injury, walked about for four days before he felt obliged to seek medical advice He was immediately operated on, and the abdomen was found filled with blood, which was traced to a ruptured spleen A splenectomy was done, but the outcome was fatal

#### SPLENECTOMY FOR GUNSHOT WOUND OF SPLEEN

DR L W HOTCHKISS reported the case of a negress, twenty-one years old, who was admitted to the J Hood Wright Hospital on April 3, 1905, shortly after being shot at close range by a

32-caliber revolver On admission, the patient was in moderate shock, and presented a small wound in the left anterior chest wall, near the cartilage of the tenth rib On the same side, posteriorly, there was a hæmatoma this was about three inches from the spine, at a point corresponding to the eleventh rib, and beneath it the bullet could be felt Her condition on admission was so good that it was first thought the wound was not a penetrating one About two hours later, the patient's only complaint was of pain near the site of the wound, and in the upper part of the abdomen There was, however, well-marked spasm of the abdominal muscles, and tenderness over the upper left abdominal segment The pulse was somewhat rapid Percussion over the left chest was negative An immediate operation was advised and performed

A vertical incision was made over the site of the wound and extended downward through the outer fibres of the left rectus muscle to the level of the umbilicus, and the peritoneum opened The track of the ball passed backward between the cartilages of the ninth and tenth ribs, through the diaphragm, thence in and out of the anterior wall of the transverse colon, wounding the tail of the pancreas, then passing through the spleen and out through the diaphragm posteriorly, fracturing the eleventh rib The bullet finally lodged in the soft parts about this rib, and was not altered in shape

As soon as the peritoneum was opened, free blood and clots escaped, but there seemed to be no fresh hæmorrhage A rapid search was made of the various abdominal viscera, and two bullet holes were found on the anterior free surface of the transverse colon, about three inches apart, and fairly well sealed by the prolapsed mucosa These were closed by purse-string sutures, fortified by an overlying Lembert stitch Several large clots were washed out of the splenic pouch of peritoneum, and on examination of the spleen, which was readily pulled up through the wound, it was found to be perforated from within outward by the bullet, which had passed through from a point on the antero-internal surface, just in front of the hilum and about the middle of the organ, to the middle of the external surface, and thence through the diaphragm, fracturing the eleventh rib The bullet could be felt through the hole in the diaphragm lying with fragments of the fractured rib beneath the skin There was no wound of the



small intestines, but the tail of the pancreas was partially shot through transversely, and there was some oozing from that organ. After ligating the gastrosplenic omentum, the spleen was removed, and it was thought best to close the anterior wound and drain posteriorly this wound in the pancreas. Accordingly, an incision was made over the fractured rib behind, and its fragments were removed, together with the bullet. Through the hole in the diaphragm the packing of gauze in the pancreatic wound was led out, the wound being enlarged downward through the diaphragm for this purpose. As the pleural cavity was opened, the upper end of the diaphragmatic wound was closed, and an attempt made to exclude the pleura from the abdominal drainage opening by suturing the diaphragm to the parietal pleura and packing it with a separate string of gauze. The patient was infused with hot saline solution during the operation, and left the table in fair condition. On the following day the patient's condition seemed somewhat improved, though the respirations were very rapid and the embarrassment of respiration painfully evident. Water was taken by mouth, and there was no vomiting.

On April 4, on account of the oozing, the outer dressings had to be changed. The abdominal packing and the wick to the site of the pleural opening were withdrawn, and replaced by small drainage strips of gauze. There was free oozing of bloody serum into the dressings.

On the following day, the patient's temperature was higher. There was free oozing into the dressings, which had to be changed twice daily. There was considerable odor to the discharge from the site of the pancreatic wound, and the gauze was stained with a light, brownish, foul-smelling fluid.

On April 6, œdema of the lung developed and the patient died. The autopsy showed that the left lung was completely collapsed, and the left pleural cavity partly filled with blood-stained serum. The peritoneal cavity also showed some sero-sanguinous fluid in the pelvis, and in the lesser sac, about the pancreas, some yellowish, foul fluid was found. There was no extending peritonitis, and no other wounds of the intestine or other viscera were found.

#### RUPTURE OF SPLEEN

DR HOTCHKISS showed a spleen which had been removed at operation about a week before. This was the third splenectomy

that had been under the speaker's care since February of the present year, two of them had occurred within one week

The patient was a male, twenty-three years old, who was admitted to the J Hood Wright Hospital on April 5, 1905, with the history of having fallen with a section of concrete flooring through four stories of a building on which he was at work, striking against various beams and obstructions in his descent. When first seen by the ambulance surgeon, he did not seem to be much injured, and declined to go to the hospital, but was finally persuaded to do so. Shortly after reaching the hospital he began to complain of severe abdominal pain, and when seen by Dr Hotchkiss, shortly afterwards, he was drawn up in bed and complaining of intense pain. He had not vomited. Bloody urine had been withdrawn from his bladder by catheter. The abdominal rigidity was well marked, and the abdomen was quite tender, especially over the left side. A diagnosis of probable rupture of a solid abdominal viscus, with resulting internal hæmorrhage, was made, and, as the patient was in a condition of shock, and the rigidity of his abdominal muscles was suggestive of serious internal damage, an immediate operation was decided on, and performed about two hours after the accident.

*Operation*—Under gas and ether anæsthesia, a left median incision was made through the fibres of the rectus. When the peritoneum was opened, dark blood in large amounts poured out. Immediate search was made for the spleen, but as the organ was large and its lower two-thirds uninjured, the damage to it was not at first clearly made out. As the blood welled up from the pelvis, the incision was extended downward and the bladder and kidney palpated. As no gross rupture of these organs could be made out, the spleen was re-examined and found to be completely ruptured at a point above its middle. There was a loose middle fragment which came away with the hand, and an upper fragment consisting of the upper pole of the organ, which was attached by some adhesions to the diaphragm. There was also a small loose piece which was washed out of the pelvis by the stream of saline solution.

The remains of the organ, consisting of the lower two-thirds, was pulled into the wound, its omentum ligated, and easily removed. The upper fragment was peeled off the diaphragm and also removed. The left kidney was again carefully palpated

and did not seem to be ruptured. As no further injuries were found, the abdominal wound was closed after partly filling the cavity with warm saline solution. Patient returned to bed in rather extreme shock, from which he soon rallied.

The course of convalescence ran smoothly enough until the seventh day, with the exception of a cough, when on account of tension the sutures were removed. The day following, the wound was found to have reopened and some intestine and omentum to be protruding. He was taken to the operating room, etherized, and the prolapsed intestine and omentum returned and the wound tightly sutured. It was found at this operation that the adhesions between some of the coils of gut were of considerable extent, and the freeing of these coils necessarily left several areas denuded of peritoneum, which areas were covered as far as possible with Cargile membrane, although some of the latter became displaced when the intestines were returned.

Five days later the patient developed signs of acute and complete intestinal obstruction, for which operation was promptly done April 17. The acute angulation of adherent loops of small gut was found responsible for the condition, and these bands and adhesions were divided as speedily as possible, but the patient succumbed to the shock of operation and died about two hours later.

DR LILIENTHAL said that in one case of rupture of the spleen that had come under his observation, he temporarily checked the hæmorrhage by packing the wound with gauze, but the patient died. He thought Dr Hartwell acted rightly in removing the spleen in the case he showed, as it was impossible to accurately determine the nature of the injury without loosening the adherent omentum, and having once done that, and encountered bleeding, nothing remained but to remove the spleen.

DR ERDMANN said that about a year ago he saw a child under five years old with a transverse rupture of the spleen, near the hilum. He closed the rupture by putting in four sutures, and the child recovered. In another case seen one month previous to that in the service of Dr J E Kelly, in which there was multiple laceration and fragmentation of the spleen, the organ was removed and the child recovered.

DR BLAKE said he had obtained good results in treating these cases by packing the wound and leaving the spleen. He

did not think it was necessary in all cases to remove the organ. In certain cases, however, where the rupture was near the hilum, efficient pressure was impossible, and under those conditions removal of the spleen was advisable.

DR GEORGE WOOLSEY said that about eighteen months ago he saw a case of hæmorrhage of the spleen following injury. The patient was an Italian, who gave a history of malaria. The spleen was enlarged and somewhat adherent, and, as the bleeding could not be satisfactorily controlled by packing, the organ was removed. The patient died. Packing of the ruptured spleen seemed to the speaker to be a difficult matter, unless it were possible to retain the packing by temporary catgut sutures.

#### FRONTAL SINUS SUPPURATION

DR ROBERT H M DAWBARN presented a man of fifty years of age who was brought to him by Dr J A Hays, of New York City, with a history of having suffered from this disease for at least five years.

*Operation*—The eyebrow was shaved and split along the orbital edge as far out as the supraorbital vessels and nerve. The more usual vertical skin-incision up the forehead, leaving a very perceptible scar, seems quite unnecessary. Next, the cavity was freely exposed by use of a coarse dental drill followed by a rongeur, this opening being just below, instead of involving, the orbital edge, to prevent a subsequent sinking in of the eyebrow. Next, instead of the customary passage, by force, of a forceps, somewhat along the infundibulum, crushing delicate bones to make room for a rubber drainage-tube, Dr Dawbarn used the plan which he originated many years ago, which is illustrated by a wood-cut in Dr George R Fowler's article upon "Frontal Sinus Disease" in Wood's Reference Hand-Book, namely, by a peculiar bending of a probe it is passed without any force down the infundibulum and out at the nostril. This can with practice almost always be accomplished, although occasionally it may require a few minutes' manipulation, and slight modification of the shape given the probe. (Filling the infundibulum beforehand for a few minutes with dilute adrenalin chloride and cocaine solution, by greatly overcoming congestive obstruction due to the inflamed mucous membrane, facilitates this step, of course.)

A stout thread is next tied behind the knob of the probe, and drawn through, and, finally, by the aid of this thread a piece of soft rubber catheter, well fenestrated, is drawn down into place for effectual drainage

After the discharge has almost ceased, the upper end of this tube is shortened well down, and the split eyebrow freshened and united. Finally, perhaps a fortnight later, the remainder of the tube is withdrawn through the nostril

Attempts to convey drainage from below upward through the infundibulum are rarely successful, and a fatal case, due to piercing the brain through softened bone while using a stiff instrument in such an endeavor, is recorded in several text-books

#### MALPOSITION OF THE APPENDIX AS A CAUSE OF FUNCTIONAL DISTURBANCES OF THE INTESTINE

DR JOSEPH A. BLAKE read a paper with the above title, for which see page 394

DR WILLY MEYER said his experience had convinced him that malposition or kinking of an uninflamed appendix was not of rare occurrence. He could recall a number of cases where the symptoms pointed to appendicular trouble, and where the patients were entirely relieved by removing a seemingly normal appendix with a short meso-appendix. The symptoms this condition gave rise to were apparently of a reflex character. Such patients frequently complained of more or less continuous pain, sometimes mild, at other times severe, but did not have a frank attack of appendicitis. In some instances, the speaker said, he had been led to suspect this condition, and he had expressed the opinion to the patients that there was something wrong in the anatomical condition of the appendix. He could recall cases where he found nothing but peri-appendicular adhesions to the cæcum, which were easily peeled off. The reflex symptoms in these cases were sometimes referred to the epigastrium, and were often very vague in character.

DR JOHN B. WALKER said that in operating on interval cases of appendicitis, it was not uncommon to find the appendix in a malposition. In a case seen only a few days ago the patient was a woman of thirty years, who gave a history of three previous attacks of appendicitis. There was abdominal tenderness, more or less generalization, with slight distention. The leuco-

cyte count was 25,000 The usual incision for appendicitis was made, but the appendix could not at first be located, it not being in the normal region Further investigation with the finger disclosed the tip of the appendix very high up, at a level with the lower pole of the right kidney A second incision was made at the outer border of the right rectus from the edge of the ribs downward The appendix was gangrenous and was removed Both wounds healed per primam

DR WOOLSEY said that in one of the type of cases mentioned by Dr Blake he thought the malposition of the organ was often due to adhesions from previous inflammation and not from congenital causes He recalled a number of cases of malposition from adhesion, where he found the adherent appendix well up behind the cæcum and colon, dragging the cæcum itself out of position About ten days ago he had operated on a member of the house staff of a hospital, and in that instance he found the appendix high up behind the ascending colon, and dragging the cæcum up and back The history of these patients was not always typical of appendicitis, the classical signs of the disease were not all present, but removal of the organ seemed to effect a cure of the intestinal disturbance and of the local pain and tenderness

DR DAWBARN said the differential diagnosis between appendicitis on the one hand and right ovarian or tubal inflammation on the other hand was sometimes a difficult matter, and in examining such patients, the speaker said he had come to lay stress upon the following point When, with the finger in the rectum, the tenderness was found towards the back of the rectum, it was due to inflammation of the appendix rather than of the ovary or tube,—the appendix in about one-fourth of the cases entering the pelvis,—whereas, if it (the tenderness) was in *front* of the rectum, it was due to the latter and not to the appendix The rule was not infallible, but very helpful

DR LILIENTHAL said he had seen several cases in which constipation was a symptom of malposition of the appendix, and in which the constipation was entirely relieved after removal of the appendix for chronic inflammation In one instance the appendix was up behind the outer side of the colon, and was not really inflamed, nor apparently had it been In another case there had been one severe attack of appendicitis, from which the patient had entirely recovered In both instances the constipation

was relieved by removal of the appendix. The explanation offered for the constipation in these cases was that the adhesions caused inhibition of the peristaltic action of the bowels.

DR BLAKE, in closing, said that in some of these cases there was constipation, in others diarrhoea and fermentation. The complex of symptoms was hard to unravel at times. He thought it was reasonable that these symptoms were the result of a short meso-appendix. The cæcum, constantly tugging on the appendix and meso-appendix, might give rise to pain and discomfort, and it was perfectly rational to accept the theory that by remedying this condition we might relieve the symptoms.

### INTUSSUSCEPTION OF SMALL INTESTINE

DR BENJAMIN T TILTON presented a specimen removed from a child of nine months who forty-eight hours before admission began to show symptoms of intestinal obstruction, with the passage of blood per rectum. Examination showed very slight abdominal distention and rigidity, with some tenderness. High up on the right side, below the free border of the ribs, a small tumor could be distinctly mapped out. The child's general condition was poor. The pulse was feeble and rapid, temperature,  $102^{\circ}$  F.

An incision was made over the swelling, and the tumor exposed. It was found to involve the small intestine high up, and it was so movable that it was easily delivered through a small abdominal incision. It was found to consist of an invagination of the gut, as it was impossible to reduce it, a rapid resection was done, and the cut ends united with a small Murphy button. There was considerable shock, and the child survived about eight hours.

Dr Tilton said the specimen seemed worthy of presentation on account of the rarity of intussusception confined to the small intestine.

DR ERDMANN said he had never seen a recovery after resection of the gut in a child under one year of age, nor had he ever seen a case, although having now his thirty-first case, in which the small intestine alone was involved, as in the specimen shown by Dr Tilton.

## REVIEWS OF BOOKS.

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OPERATIVE SURGERY By DR JOSEPH D BRYANT, Professor of Surgery at Bellevue University Medical College, New York City Fourth Edition D Appleton & Co, 1905

That four editions of this well-known work should have been called for at intervals relatively short is an indication of the estimation in which it is held by the profession, and also evidence that the distinguished author is determined that the operative surgery which bears his name shall be the last word on the subject, so far as this is possible in an age of rapid change and constant improvement. This edition has been thoroughly rewritten, and has been printed from new plates. It contains about 250 more pages than the previous edition and 200 more illustrations. It is the most complete work on operative surgery which has yet come under the notice of the reviewer. In the introductory chapter of the first volume the author generalizes broadly and lays down a number of maxims, and makes many commentaries which are worth the most careful consideration of the young surgeon, nor will the older operator lose anything by an occasional review of this chapter. In these days of commercial, not to say bargain counter, surgery, men whose rashness and desire for the rewards of the surgeon outpace their knowledge and capacity may well ponder over the following observation of Dr Bryant. "An understanding of the anatomy of the parts involved in the operation is always essential to the comfort of the operator and frequently to the safety of the patient." The first part of this commentary we fear is superfluous, since the man who operates from the commercial stand-point is not apt to be troubled about his own ignorance. Indeed, even the safety of the patient will



concern him only in so far as it may affect future fees. The author further says that this knowledge is somewhat difficult to acquire and always of uncertain tenure. This is a good text for a sermon on the necessity of a long apprenticeship in the demonstratorship of anatomy as a prerequisite to real surgical attainments. We believe that it would be difficult to point out any of the surgeons of the first rank in this country who have not served such an apprenticeship. One may epitomize Dr Bryant's remarks on this subject rather bluntly as follows: "Better learn your anatomy before you try to operate. You cannot learn it out of a book. Learn from the cadaver." This does not sound as smoothly as Dr Bryant's flowing sentences, nor does it drop trippingly from the tongue, but it is what the author means, nevertheless.

The most important additions to the first volume occur in the chapter devoted to intracranial neurectomy, which contains an account of every operation for the relief of trigeminal neuralgia which has ever been suggested. Matas's new procedure for aneurism is well described, so is Cushing's operation for nerve grafting for the relief of facial paralysis. The description of the operations on the mastoid antrum has been elaborated, and some new procedures and instruments concerned in the surgery of the œsophagus are minutely described. It is with some surprise that we search in vain in the article on plastic surgery for any mention of Brophy's methods in cleft palate. The second volume contains many new operations on the intestinal tract. Indeed, there is not a single operation which has been omitted. All the various devices for facilitating intestinal anastomosis are here illustrated. There is not a stitch which has ever been invented which is not illustrated in these pages. McGraw's recent method of colectomy, Moynihan's gastro-enterostomy, Mayo's pylorectomy, and Finney's pyloroplasty are all clearly described. The section on the surgery of the kidney describes the investigations of Broedel and Kelly on the arterial supply of this viscus and its relation to nephrolithotomy. There is much new matter in the

article on herma, besides clear descriptions of all the standard operations for the relief of this infirmity The article on the surgery of the prostate contains a lucid description of all the recent work that has been done in this important branch of surgery There is not an operation of moment which has been omitted in any branch of surgery, except those which the author has specifically omitted, namely, operations of the female pelvis and the surgery of the eye The descriptions and illustrations throughout are so clear that it is impossible to misunderstand them Nevertheless, let the tyro be not deceived Let him take Dr Bryant's advice and learn his anatomy in the dissecting-room At the same time, if he will not or cannot do this, there is no book which will keep him out of trouble so far as a book can do so like this work of Dr Bryant

ALGERNON THOMAS BRISTOW

THE URINE AND FÆCES IN DIAGNOSIS By OTTO HENSEL, Ph G, M D, Bacteriologist, German Hospital, New York, and RICHARD WEIL, A M, M D, Pathologist, German Hospital, New York, in collaboration with SMITH ELY JELLIFFE, M D, Ph D, Instructor in Pharmacology and Therapeutics, Columbia University, Visiting Neurologist, City Hospital, New York Illustrated with 116 Engravings and 10 Colored Plates Philadelphia and New York Lea Brothers & Co, 1905

Numerous as are the works on urinalysis, this volume has much to recommend it over its predecessors, for it is replete in all the modern methods which have contributed towards making the analysis of urine a most exacting study, demanding rather more than the reagents for albumen and sugar and a microscope

A very commendable feature is that the urine is studied not merely from the laboratory stand-point, but the findings of the analysis are everywhere harmonized with the clinical picture By far the greater attention has been given to the chemical analy-

sis of the urine, whereas the microscopic examination of the cellular elements found in a pathological specimen of urine and the bacteriology are in for a brief consideration. A very signal service has been rendered by the decided manner in which it is once more stated that a microscopic examination of the cellular elements is no ear-mark of the location of the disease in the kidney, pelves, ureter, or bladder.

In regard to tubercle bacilli, insufficient stress has been laid upon the need of repeated search for these in a urine in which they are suspected, and the teaching that urine injected into the abdomen of a guinea-pig will, if it react, contain tubercle bacilli, is not precise, since that animal must first be proven healthy by a previous injection of tuberculin, and then the urine must not be overladen with pus organisms, for, if these predominate, the animal will succumb to septic poisoning.

There is no gainsaying that staining gonococci with methylene blue or Jenness stain is easiest, but it certainly is not paramount to the Gram stain, which latter, as given in a modified form, tends to confusion.

The remainder of the work is devoted to an examination of the fæces, a hitherto unexplored field. As stated in the preface, this share of the work is a compilation of scattered writings, but largely made possible by a perusal of the monograph of the German investigators, Schmidt and Strassburger.

MARTIN W. WARE

ACUTE CONTAGIOUS DISEASES By WILLIAM M. WELCH, M.D.,  
and JAY F. SCHAMBERG, A.B., M.D., Philadelphia. Pp. 781.  
Fully illustrated. Philadelphia and New York: Lea Brothers & Co., 1905.

The present volume is the result of observations made at the Municipal Hospital of Philadelphia during the past thirty-five years, among which are the records of 9000 cases of smallpox, a similar number of scarlet fever, and 10,000 of diphtheria. A

text of 642 pages is used in the discussion of these three diseases alone

The history of each disease has been carefully reviewed by the authors, and forms the introduction of each contribution. Among the diseases treated other than the above are chicken-pox, measles, rubella, and typhus fever.

The subject-matter is comprehensive, easily readable, and not confused. The treatment of the many complications of each disease is gone into in detail, and will prove especially welcome to the general practitioner.

The illustrations are profuse and very commendable, in several instances series of photographs show the successive stages of the various diseases, and also those with which they might be confounded,

JAMES TAFT PILCHER

UNTERSUCHUNGEN UEBER KNOCHEN ARTERIEN mittelst Rontgen Aufnahmen injizierter Knochen und ihre Bedeutung für einzelne pathologische Vorgänge am Knochensysteme. Von Prof. Dr. E. LEXER und Dr. KULIGER und Dr. WOLFG. TURK, Volontär-Assistenten der Königl. Chirurgischen Universität's Klinik Sr. Excellenz von Bergmann, Berlin. Mit 22 Stereoscopischen Bildern, u. 3 Tafeln. Berlin: August Hirschwald, 1904.

The funds of Countess Bose were used to defray the expenses of the costly experiments, the valuable results of which are presented us in this monograph.

The blood was first washed out of the bones by the injection of physiological salt solution into the carotids, and this followed up by the injection of mercury rubbed up with turpentine. In adults the injections were made successively into the main artery of each extremity. The injection of the plexus of the blood-vessels of the periosteum and joint capsules was so dense in the radiographs taken as to obscure the arrangement of blood-vessels in

the interior of the bone All radiographs were taken from bones stripped of periosteum and capsule The bones of young infants and children were best adapted to show in radiographs that there are three areas of vascularization,—the zone of the diaphysis, that of the epiphysis, and that of the metaphysis

Then follows a detailed account of the distribution of these vessels in the long and short bones, illustrated in twenty-two stereoscopic radiographs printed on diaphanous paper so as to permit their being viewed in an American stereoscope

Two concluding paragraphs show to what extent the localization of disease in distinct foci of bone is due solely to embolism, or rather the mechanical conditions of the arterial system

Senile changes of bones are also to be explained by such retrograde changes that affect the blood-vessels of the diaphysis, so that greater vascularity is peculiar to the epiphyses We have therefore in old age, as well as infancy, greater vascularity as potent factors of disease

This research is limited to physiological conditions of the bone, there yet remains to investigate with the X-rays pathological specimens of bone injected with mercury One such radiograph of a sarcoma of the shoulder is added

MARTIN W WARE

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### CORRECT DIAGNOSIS AND TREATMENT OF RHEUMATISM

By G W TOBIAS, M D, NEW YORK

In considering the pathology of so-called rheumatism, it is essential to be discriminating before applying antirheumatic medication

Rheumatism is self-limited and disappears when the pabulum which it needs is exhausted, but one attack of rheumatism does not confer immunity from subsequent infection, on the contrary, once a rheumatic, always a rheumatic. This is probably because the microorganism lies dormant and only develops when systemic resistance is sufficiently lowered. Rheumatism and gout present many similar symptoms. Rheumatism will by preference attack the large joints or the heart, while gout occurs most frequently in the small joints. Gout is more common in the aged, while rheumatism is more prone to affect those in the most vigorous decades of life. There are, moreover, two essential features in which rheumatism differs from gout and all other arthritides, the character of the temperature and the peculiar lactic acid odor of the perspiration and breath.

Rheumatism is a true disease, while gout is a condition due to the retention in the system of morbid metabolic products, hence both conditions may, and very often do, co-exist. In almost any condition in which the temperature is high or continuous, gout exists as a complication, hence such cases may be appropriately treated with colchi sal.

Gros, of Paris, was one of the first to recommend betul-ol in connection with

colchi-sal capsules in gouty cases complicated by a rheumatic diathesis.

Betul-ol is a mentholeic acid combined with the methylester of the salicylic radicle, resulting from the action of water on a glucoside and a ferment present in the bark of the tree, *betula lenta*. I find betu-ol the best of this class of remedies, one minim being chemically equivalent to one grain of salicylate when taken up in the blood current, by which means it is brought in direct contact with the diseased structures.

It is not irritating to the skin, and as it contains two per cent of menthol, it has an advantageous local analgesic effect which gives almost immediate relief from pain.

Betul-ol is best used with friction, but when the patient's condition and the tenderness of the skin do not admit of this, it can be applied on absorbent cotton and covered with oil silk tissue. Where friction is permissible, the following formula will be found useful.

R	Betu-ol	2 grains
	Alcohol	5 "
	Ol Ricini	3 "
Sig M ft Lin		

For external use. This quantity is to be used at a single application. Where there is great pain—morphine or cocaine can be added to the liniment. It is hoped that the perusal of this article may lead to fewer disappointments in diagnosis and greater success in treatment, and since salicylates taken up through the skin are much more effective in smaller doses than when sodium or other salicylates are administered *per os*, the advantage is considerable in more ways than one.

## WHAT SHALL IT BE?

This question is present in the mind of the busy physician every summer when he confronts the problem of appropriate tonic medication for the weak, poorly-nourished and debilitated

The next question to be decided is, what remedy has a selective action on the gastro-intestinal mucous membrane whereby its functions are kept in a normal condition? In other words, how may the natural tendency of hot weather to set up irritation of these organs be combatted, and at the same time how can the patient be properly nourished? A moment's thought as to the physiologic effects of Gray's Gly-Tonic Comp will answer these questions and explain why this remedy is the best tonic and reconstructive for Summer use

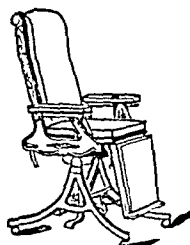
First of all, Gray's Tonic is one of the most prompt and reliable gastric sedatives known to the profession, as instance of this it is only necessary to recall its wide-spread use in the gastric irritability and vomiting of pregnancy and sea-sickness. Once having pacified the stomach it exerts very positive effects upon the secretory and motor functions of this organ, manifested by creation of appetite and increased power to digest food

## RELIEF IN NEURALGIA AND GIRDLE PAINS

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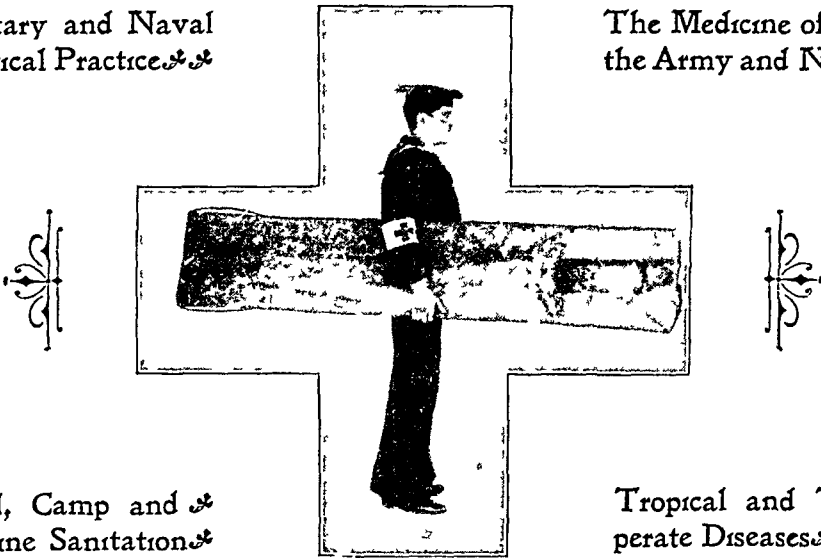
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From the *Medical Herald*, of St. Joseph, Mo.

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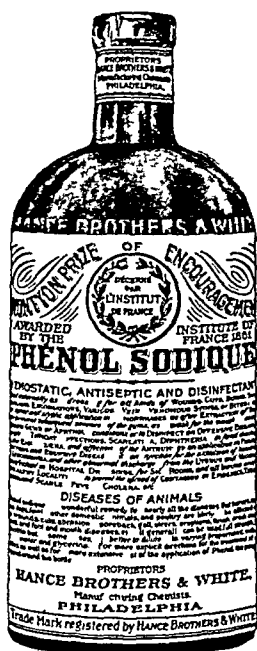
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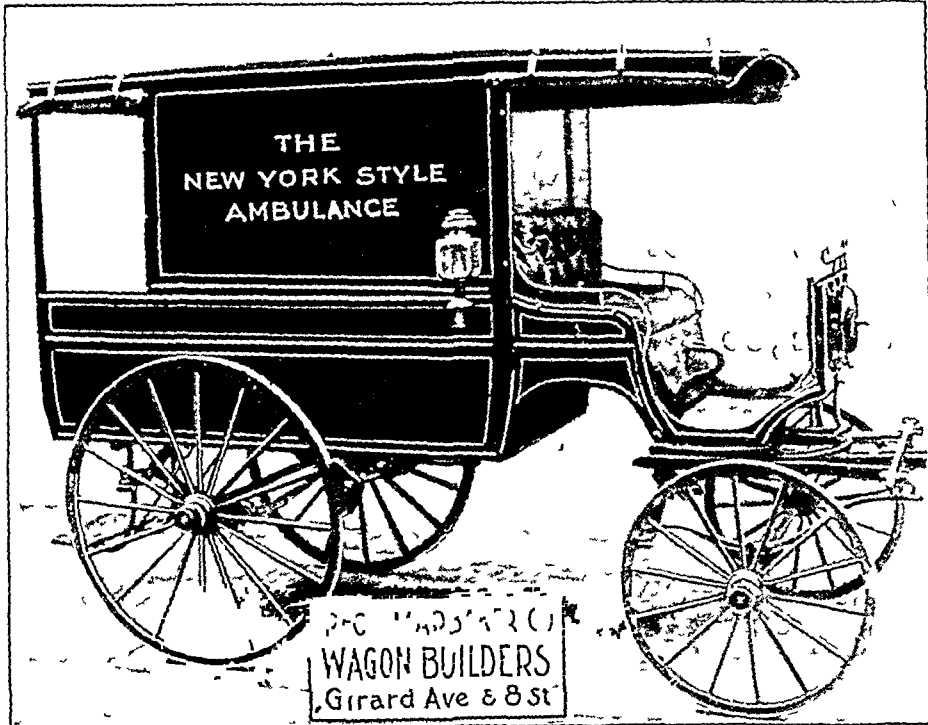
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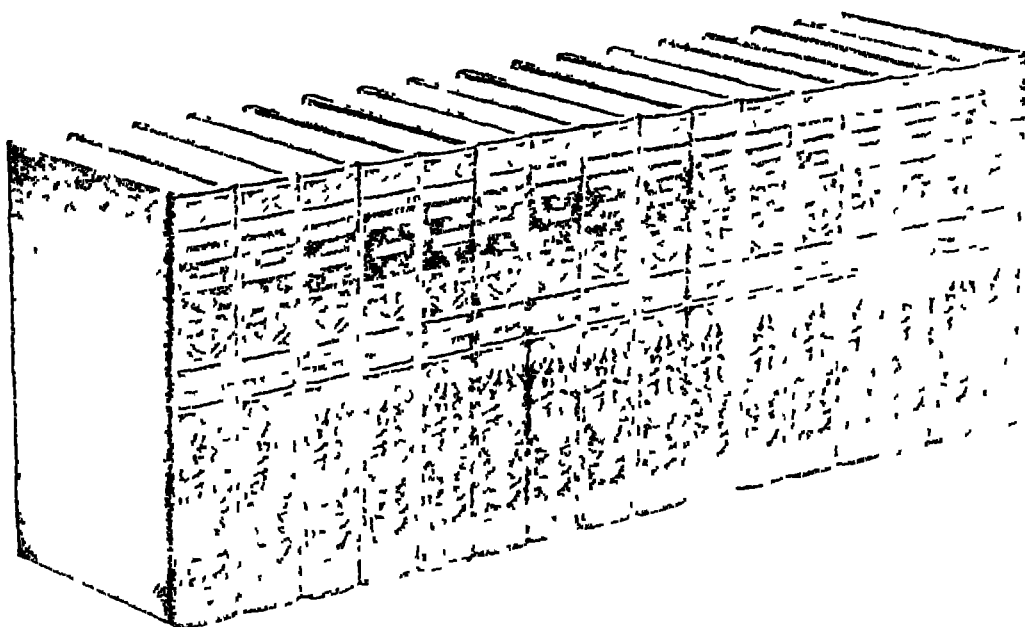
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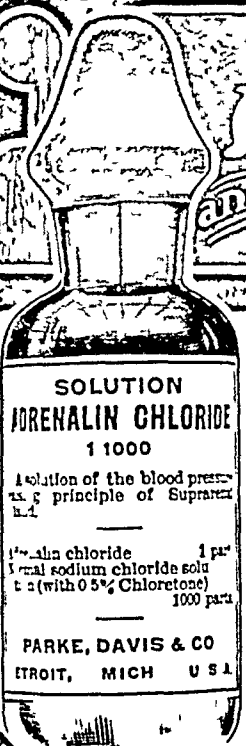
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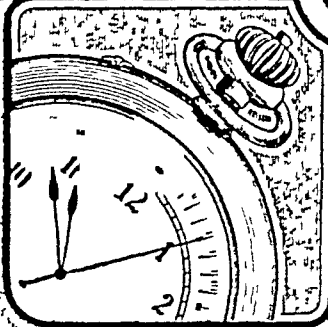
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# ANNALS OF SURGERY

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No 1

## ORIGINAL MEMOIRS.

### OF LIGATURE OF THE INNOMINATE ARTERY.

WITH REPORT OF A SUCCESSFUL CASE

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*I Introduction*—Prior to the present case, ligature of the innominate artery had been performed successfully seven times, viz, three times in the United Kingdom, three times in the United States, and once in India. The writer's case, therefore, seems worthy of record, and a study of the literature of the operation leads further to the conclusion that the process of collecting and commenting upon the accounts of previously recorded cases will also be instructive and will form an interesting chapter of surgical history. This, therefore, has been carried out, and every effort has been made to render the collection of cases complete, and to omit no essential points in their record. In spite of its previous high mortality the operation is one which, under modern surgical conditions, the writer believes has a safe and useful future.

*2 Summary of Present Case*—The patient a man aged forty-six years, a laborer, formerly a soldier, was admitted to the Cardiff Infirmary on February 2 1904. He had an aneurism of the second and third parts of the right subclavian artery, the symptoms of which commenced six months previous to admission. On March 31, 1904, the innominate and the right common carotid



arteries were tied Pulsation ceased in the aneurism, but was found to have returned to some extent on the following day On May 19 an unsuccessful attempt was made to again tie the innominate On June 2 the second part of the subclavian was tied close up to the aneurism Recovery took place with consolidation of the aneurism, and the man remained well when last seen, eight and one-half months after the first operation

3 *Account in detail of Present Case*—W T, male, aged forty-six years, admitted to the Cardiff Infirmary, February 2, 1904, being sent by Dr T W Thomas, of Caerphilly, near Cardiff

*History*—Laborer since 1885, previous to that in the army, having served in the Bermudas and in the Egyptian campaign of 1882-1884 No history pointing to venereal disease Has heavy straining work to do Has never had a blow at the site of the aneurism Admits alcoholism

*Present Trouble*—This began six months before admission, with numbness and tingling in the right hand, these symptoms have persisted and become more marked, the numbness and tingling extending up the arm Sometimes the pain in the arm is so great that he cannot raise his hand to his head He did not notice the swelling until January 27 (six days before admission), and he attributes its presence to a "jar of the hammer" with which he was working on that day He worked until January 30, then reported himself ill, and was sent to the Infirmary

*On Admission*—The general appearance is shown by the photograph (Fig 1) He is a fairly strongly built man, but pallid and with flabby muscles

*Aneurism*—Pulsating swelling above clavicle in situation shown in photograph, projects more from the general surface, and is more marked in all respects when the patient sits up than when he is lying down, pulsation heaving, expansile, not forcible, systolic bruit, slight rise and fall during respiration, general form circular, with an upward and outward expansion, greatest breadth, 6 centimetres, height of upper margin above clavicle, 5 centimetres, centre raised above general surface 1.5 centimetres, overlapped anteriorly by sternomastoid and posteriorly by trapezius, lower margin lies behind clavicle, but finger can be got between clavicle and swelling, pressure causes shooting-pains in axilla, no dulness over manubrium sterni



FIG. 1.—The patient before operation. The outline of the aneurism, the upper border of the clavicle and the inner margin of the sternomastoid have been marked in India ink.



*Pressure Symptoms.*—The radial pulse is only just perceptible, requiring great care in order to feel it, the same observations apply to the brachial and axillary pulses, the radial pulse-rates are equal, there is no difference between the carotid or the temporal pulses on the two sides

The veins are slightly dilated over the upper and outer part of the right chest and over the front of the right shoulder, there is a dilated vein running up the front of the arm over the middle of the biceps muscle There is no œdema of the arm

There is pain over the scapula Tingling pains run down the arm from the axilla "Dead fingers" and "cramps" are complained of in the hand The fingers of the hand have a bluish-white, "dead" appearance as compared with those of the opposite side The pupils are equal and react to light and accommodation There is no alteration in the voice and no cough

*Other Symptoms*—Heart Apex beat palpated with difficulty in fifth space in nipple line, otherwise normal Arteries not atheromatous Left radial pulse good volume, rate, 66 Lungs normal, breathing quiet, sixteen to the minute, no expectoration Occasional dyspeptic symptoms,—pain and flatulence Slight enlargement of liver Urine normal No swelling of feet Evidence of venereal disease, none The whole body was carefully examined

Subsequent progress prior to operation The patient was found to be suffering from scabies, with the accompanying eczema and numerous "boils" about the body and limbs This necessitated a prolonged course of treatment The aneurism increased slightly in size The pressure symptoms varied from day to day, but underwent no marked exacerbation The patient was usually allowed up daily and had a generous diet without stimulants

*Operation*, March 31, 1904, two months after admission The greatest care was taken to secure asepsis The preparation of the patient's skin was commenced forty-eight hours before the operation The operator, assistants, and nurses wore sterilized cotton gloves, and were clothed in sterilized linen overalls The anaesthetist was screened off by a sterilized linen cloth stretched over a copper wire framework Only the situation for the incision and the skin immediately adjacent were exposed, the sterilized cloths being stitched to the skin around this area Pieces of sterile gauze were used for swabs Knives and scissors were

sterilized by immersion in and wiping with carbolic lotion, other instruments by boiling. Needles had been previously prepared, and were stored in absolute alcohol. With the exception of the silk used for the innominate itself, ordinary Chinese twist was used throughout for ligatures and sutures, which had been prepared by boiling and was stored in absolute alcohol.

Chloroform was administered by Dr F W S Davies. Mr William Martin, Assistant Surgeon to the Infirmary, and Mr Brownlee, Resident Medical Officer, assisted the operator.

A median incision was made five inches long, extending from over the cricoid cartilage to an inch below the sternal notch. The cervical fascia was divided, and the sternolaryngeal muscles separated in the middle line and drawn apart throughout the length of the incision. The lateral lobes and the isthmus of the thyroid were exposed in the upper part of the wound. The operator, who had been standing on the right, now crossed over to the patient's left side and worked standing near to the patient's left shoulder. The dissection was carried well into the sternal notch, and a long process of tissue, probably remains of the thymus gland which lay laterally along the right side of the trachea, was removed. This process showed communicated pulsation, and was at first thought to be the carotid. The carotid sheath was next identified and opened, and the carotid followed down to the bifurcation, in doing this the thyroidea ima vein had to be divided between two ligatures. An attempt was now made to clear and identify the first part of the subclavian, it being thought it might be possible to apply a ligature to this, but, while a long narrow-bladed retractor was being adjusted to open out the lower and outer angle of the wound, a slight hissing sound occurred from this situation, indicating probably wound of the pleura. This ceased on packing in a gauze plug, but recurred when the gauze was removed. The patient gave no signs of being affected by the incident. The gauze being left in, the dissection was carried to the innominate, about half an inch of which was exposed lying obliquely against the right side of the trachea, and by means of a right-angled needle (Macewen's hernia needle) a ligature of stout floss-silk (Down Brothers, London, No 2 pearl silk) was carried round the vessel from without inward. There was no especial difficulty about this performance, and no means of illuminating the situation of ligature additional to the ordinary daylight in the operating theatre.

were needed. The silk was passed double round the artery, and the two ligatures thus provided were tied in Ballance's "stay knot," the first turn of a reef being taken in each in the same direction, and then the knot completed by treating the two ends on each side as one in making the second turn. The intention in tightening the ligature was to occlude the artery without injuring its coats. A fair amount of force was required before the pulsation in the aneurism ceased. On tightening, the anæsthetist observed the disappearance of the temporal pulse, and also noted that there was no increase of pallor on the right side of the face, no sweating of the face, and no change in the right pupil. The carotid was found flaccid, empty, and not pulsating, and a single length of Chinese twist was tied round it in a "surgical knot."

The parts fell together easily. The sternolaryngeal muscles and the cervical fascia were brought together by interrupted sutures. The hissing sound referred to above returned when the gauze plug was removed, but ceased on the application of the deep sutures. The skin wound was closed with a continuous silk suture without drainage, and sealed with sterile gauze and collodion, over which sterile gamgee tissue was fastened with broad bands of strapping. The operation lasted nearly two hours. Some time was lost owing to the patient several times partly coming round from the anæsthetic. It was impossible for the anæsthetist to observe the patient properly when he was screened off in the way above mentioned. Great caution also was observed in the various steps of the operation.

On recovering from the anæsthetic, the patient was extremely restless, requiring two nurses to restrain him, chattering nonsense, and not recognizing those about him. He was given sips of milk and water and vomited twice. At 7 P.M. his temperature was 98° F, pulse, 88, respirations, 24. At 8.30 P.M. he was given one-quarter grain of morphia hypodermically, after which he was quieter and slept at intervals, complaining of great pain in the region of the heart when awake. The mental disturbance and restlessness continued for the next two days, gradually abating. On the morning of the day following the operation a slight return of pulsation was noted in the aneurism, this became more forcible during the next three or four days, diminished again for an equivalent period so as to be almost imperceptible, then returned again and remained, but was never so forcible as

before the operation, while the aneurism had a more solid feel. The right radial pulse could not be detected, and its return was not noted until May 17, when it could be just felt as before the operation. The wound ran a perfectly aseptic course. The sealed dressing was taken off on the eighth day and the stitches removed. All dressings were left off on the twelfth day. Temperature never above  $99^{\circ}$  F, pulse only once above 90, respiration, normal rate. No chest disturbances. On April 14, a fortnight after the operation, the patient got up. Later he had a slight attack of tonsillitis, but on the subsidence of that his general health remained good. The pain down his arm and other pressure symptoms continued. My colleague, Dr D R Patterson, kindly examined his larynx on April 26, and reported slight want of mobility of the right vocal cord. During May the patient had epigastric pain and other dyspeptic symptoms. These were to a large extent accounted for when on one occasion he was found dead drunk in the hospital garden, the absence of his radial pulse much alarming the nurse who was first called to him.

*Second Operation*—This was performed on May 19. Dr Davies gave the anæsthetic, and precautions similar to those on the previous occasion were observed with regard to asepsis. The old wound was reopened, the incision over the sternum being carried somewhat lower. The procedure was more difficult and tedious than on the former occasion on account of the cicatricial tissue present. The former ligature round the innominate was identified, and half an inch of the vessel exposed on its cardiac side. On passing the point of the Macewen's needle threaded with Chinese twist outside and then behind the vessel there was an alarming gush of blood filling up the wound. On withdrawing the needle the bleeding ceased. Several attempts were made to pass the needle, but always with the same result. It was thought that the innominate vein or one of its tributaries was wounded, these parts having become adherent to the artery as a result of the first operation. The first part of the subclavian could be felt pulsating, but it would have been difficult to define, owing to the new tissue formation, and there would have been great risk of injuring the pleura. The wound was closed as before, without drainage, and sealed.

*Third Operation*—Recovery from this operation was absolutely uneventful, and on June 2 the third operation was per-

formed under similar conditions to the previous ones. A transverse incision five inches long was made above the clavicle directly over the aneurism. After incision of the fascia various superficial veins, including a large external jugular, were divided between two ligatures. The outer edges of the sternomastoid and scalenus anticus were identified and cleared. The omohyoid was a little puzzling at first, forming a long whitish cord bound down, as far as it appeared in the wound, to the clavicle. After recognition it was divided. Another large vein running deeper to and parallel to the external jugular was tied and divided. The more difficult part of the operation now commenced, the pulsating aneurism filling up the wound. The sternomastoid being retracted, the dissection was carried down between the inner side of the aneurism and the scalenus anticus, and, the latter muscle being also retracted, a small portion of artery internal to the aneurism was exposed. The artery appeared healthy and the aneurism sprang suddenly off it, having a globular form and so situated that the artery entered the internal and posterior part of the aneurismal sac. The phrenic nerve, which was clearly exposed on the surface of the scalenus, being retracted, the outer half of the scalenus was divided transversely with scissors. No disturbance of respiration took place during the process. The aneurism being held outward and the partly divided scalenus further retracted, about three-quarters of an inch of the artery was exposed and cleared. It was somewhat difficult to get a needle round, as the left hand of the operator was partly occupied in retracting the aneurismal sac, which otherwise bulged over the artery, completely hiding it. A ligature of stout (No. 4) Chinese twist was passed round the artery about half an inch from the sac and tied in a "surgical knot." Pulsation in the aneurism ceased. A second similar ligature was passed and tied distal to the first, close up against the sac. The wound was kept bloodless throughout, the parts fell together, leaving no pockets, superficial structures and skin were brought together as in previous operations, and the wound sealed without drainage.

Recovery was uneventful. The patient was restless, inclined to sit up and turn about, and had to be constantly watched. The arm was kept wrapped in wool for a week. It was not so pink under the nails as on the other side, otherwise the circulation was unaffected. There was no pulse in the arteries of the limb. The



4—TABULAR STATEMENT OF CASES

No	Operator	Place and Date of Operation	Sex and Age of Patient	Disease and its Duration	Incision	Vessels Tied	Material of Ligature and Kind of Knot	Result
1	Valentine Mott	New York Hospital, May 11, 1818	Male, 57	Traumatic subclavian aneurism, 2½ months	Mott's	Innominate	Round silk	Death, 26th day, sepsis, hemorrhage
2	Graefe	Berlin University Clinic, March 15, 1822	Male, 30	Subclavian aneurism, "rapid growth"	Inner border sterno mastoid	Innominate		Death, 67th day, sepsis, hemorrhage
3	Norman	United Hospital, Bath, 1824	Male	Subclavian aneurism		Innominate		Death, 5th day, acute pericarditis
4	Arendt	Wanhoof Hospital, St Petersburg, 1827	Male, 36	Subclavian aneurism, ? traumatic, 1 year	Inner border sterno mastoid	Innominate		Death, 8th day, sepsis
5	Hall	Baltimore Hospital, September 7, 1830	Male, 52	Subclavian aneurism, 9 months		Innominate		Death, 5th day, sepsis, hemorrhage Needle passed through vessel
6	Bland	Benevolent Asylum, Sydney, New South Wales, March 26, 1832	Male, 31	Subclavian aneurism, 2 years	Mott's	Innominate	Ligature consisted of "two threads"	Death, 18th day, sepsis, hemorrhage
7	Buyalsky	Military Hospital, St Petersburg, May 11, 1833	Male, 56	Subclavian aneurism		Innominate	Tied by "tour-niquet"	Death, 5th day, sepsis
8	Buyalsky (second case)			Subclavian aneurism ?				Death
9	Quoted by Dupuy-tren	Paris		Subclavian aneurism ?				Death, 3d day, hemorrhage

10	Lizars	Royal Infirmary, Edinburgh, May 31, 1837	Male, 30	Traumatic subclavian aneurism, 11 months	Inner border sternomastoid	Innominate		Death, 21st day, sepsis, hæmorrhage
11	Hutin (Paris)	1842	Male, 27	Wound of branch of axillary, 9 days		Innominate	Flat ligature	Moribund, death in 11 hours
12	R T Gore	United Hospital, Bath, September, 24, 1856	Male, 52	Subclavio axillary aneurism, 3 years	Mott's	Innominate	"Hempen ligature,"	Death, 17th day, sepsis, hæmorrhage
13	Progoft	St Petersburg, 1856	Male, 46	Subclavian aneurism, some years		Innominate		Death, 48 hours, acute sepsis
14	Cooper	San Francisco, 1859	Male	Innominate, subclavian, and carotid aneurism	Mott's summit of sternum and sternal end of clavicle removed	Innominate		Death, 9th day, kidney disease
15	Cooper (second case)	San Francisco, 1861	Male	Subclavian aneurism ?	Ditto	Innominate		Death, 34th day, sepsis, hæmorrhage
16	A W Smyth	New Orleans Hospital, May 15, 1864	Male, 33	Subclavian aneurism, 3 months	Mott's	Innominate, carotid later, vertebral		Recovery after sepsis and hæmorrhage, aneurism recurred, died April 6, 1875
17	Lynch	New York, 1867	Male	Gunshot wound of internal carotid and vertebral		Innominate		Death, 12th day, hæmorrhage
18	E R Bickersteth	Liverpool Royal Infirmary, May 7, 1868	Male, 40	Subclavian aneurism, 3 weeks	Mott's	Innominate	Lead clamp, then silk	Death on 6th day, hæmorrhage
19	A B Mott	New York, August 13, 1868	Male	Subclavian aneurism	Mott's	Innominate		Death, 23d day, sepsis, hæmorrhage
20	S B Partridge	Medical College Hospital, Calcutta, May 2, 1870	Male	Aneurism of carotid, cauterotid tied 13 days previously, 1½ years		Innominate		Moribund, death in 1½ hours

## 4—TABULAR STATEMENT OF CASES—CONTINUED

No	Operator	Place and Date of Operation	Sex and Age of Patient	Disease and its Duration	Incision	Vessels Tied	Material of Ligation and Kind of Knot	Result
21	I S O'Grady	Dublin, 1873	Male	Subclavary aneurism, 3 years	Inner two inches of clavicle removed	Innominate, carotid		Death in 20 hours, serous effusion into cerebral ventricles
22	G Buchanan	Western Infirmary, Glasgow, June 1, 1880	Male, 40	Subclavian aneurism, 4 months	Mott's	Innominate		Death in a few minutes
23	W Thomson	Richmond Hospital, Dublin, June 9, 1882	Male, 49	Subclavian aneurism, 10 months	Mott's	Innominate	Oxycort, 3 knots	Death, 42d day, sepsis, hemorrhage
24	W M Banks	Royal Infirmary, Liverpool, February 26, 1883	Male, 50	Subclavian aneurism	Mott's	Innominate	Kangaroo tendon, 3 knots	Recovery, return of pulsation 67 days later, ligation of subclavian, death
25	Bull	New York, 1884		Subclavian aneurism		Innominate, carotid, vertebral	Double catgut ligatures	Death, 33d day, hemorrhage
26	Bennett May	Queen's Hospital, Birmingham, March 27, 1886	Male, 30	Subclavian aneurism, 17 months	Mott's	Innominate	5 or 6 catgut threads, 3 knots	Death, 18th day, sepsis, hemorrhage
27	Francesco Durante	Operator's Clinic, Rome, March 25, 1887	Male, 45	Subclavian aneurism, 2 years	Mott's	Innominate, carotid, vertebral		Death, 15th day, sepsis, hemorrhage
28	J Lewtas	Murda Hospital, Punjab, India, May 13, 1889	Male, 20	Traumatic subclavian aneurism, 1 month	Mott's	Innominate, carotid	Catgut	Recovery, left hospital in 43 days

29	G E Twynam.	Prince Alfred Hospital, Sydney, N S W, 1889	Female, 18	Traumatic subclavian aneurism, 1 month	Median	Innominate, carotid	Silk	Death in 18 hours from cerebral lesion
30	W H A Jacobson	Guy's Hospital, London, February, 1890	Male, 46	Subclavio-axillary aneurism, 1 year	Mott's, inner end of clavicle removed	Innominate, carotid	Or aorta	Death, 10th day, bronchopneumonia, delirium
31	C Coppinger	Mater Misericordiae, Dublin, January 9, 1893	Male, 53	Subclavio axillary aneurism	Mott's	Innominate, carotid	Silk	Recovery on July 4, 1895, no sign of aneurism
32	C J Symonds	Guy's Hospital, London, November 5, 1894	Male, 53	Subclavio axillary aneurism	Two vertical incisions joined by transverse one above clavicle	Innominate, carotid	Floss silk	Recovery Died later of other causes
33	H L Burrell.	City Hospital, Boston, January 15, 1895	Male, 54	Subclavian aneurism, 18 months	Mott's, sternoclavicular joint and part of sternum removed	Innominate	Silk reef knot	Recovery Died, 104th day from heart and arterial disease
34	B. Farquhar Curtis	St Luke's Hospital, New York, December 2, 1899	Male, 53	Subclavio axillary aneurism, "some months"	Median, splitting of manubrium	Innominate	Chromic catgut, 2 threads tied simultaneously, then single thread distally	Recovery Some sepsis, pulsation returned, carotid and first part of subclavian tied March 13, 1900, recovery
35	C A Bellance	St Thomas's Hospital, London, April 15, 1902	Male, 35	Innominate subclavian and carotid aneurism, 6 months	Median, splitting of manubrium	Innominate, carotid	Gold-beaters' skin, stay knot	Death next day Thrombosis of middle cerebral artery
36	William Sheen	Cardiff Infirmary, Wales, March 31, 1904	Male, 46	Subclavian aneurism, 6 months	Median.	Innominate, carotid	Floss-silk, "stay knot"	Recovery Pulsation returned, ligature of subclavian, June 2, 1904, recovery

wound was unsealed and the stitches removed on the ninth day, and all dressings were left off on the thirteenth day

Three weeks after the operation there was no return of pulsation in the aneurism, which was hard and slightly tender. The pain down the arm was much less, and the tingling had disappeared, there was still slight numbness complained of in the tips of the fingers. On June 27 the patient got up, and on July 27 he left the hospital. He was kept under my personal observation until the middle of December, 1904, when he left Cardiff to live in Portsmouth. Marked pulsation was at first felt at the root of the neck over the innominate bifurcation, but this grew gradually less and less forcible, while the aneurismal sac became smaller and harder. The radial pulse reappeared faintly about two months after the operation.

Detailed examination on December 16, eight and one-half months after the first operation, shows the sac as a flattish, slightly tender area of the diameter of half a crown, it does not project, and there is no pulsation in it. A very feeble pulse can be felt in the right radial and temporal arteries, it is full and strong in the corresponding vessels of the left side, rate, 76. No pulse is to be felt in the right carotid or brachial arteries. The right arm is not blue, and its nutrition and general appearance are as good as those of the left. The man still complains of pain in the right arm and shoulder, of difficulty in lifting the right arm, and of some tingling down it. These symptoms, however, he is probably making the most of, for he has done no work since the operations, and continues to draw compensation for his "accident." The enlargement of the superficial veins of the right side has disappeared. The man is well nourished, but flabby and of a pallid complexion. His general health is good.

## 5 ABSTRACTS OF PREVIOUSLY RECORDED CASES, WITH REFERENCES

1 VALENTINE MOTT, 1818—M B, aged fifty-seven years, seaman, admitted to New York Hospital, March 1, 1818. Fall a week previously upon right arm and shoulder, followed by pain and general swelling there. Swelling partly subsided, that left above clavicle at first thought to be inflammatory, but in time developed definite pulsation. Operation, May 11 "Mott's incision," *i.e.*, a transverse incision above the inner part of the clavicle terminating over the trachea, joined to a second incision along the inner edge of the sternomastoid muscle, partial division of the sterno-

mastoid in the line of the transverse wound, transverse division of the right sternolaryngeal muscles

Subclavian found diseased Innominate tied with a "round silken" ligature half an inch below the bifurcation Suppuration Ligature came away on fourteenth day Patient up on sixteenth day Hæmorrhages on ninth and twenty-third to twenty-sixth days Death on twenty-sixth day *Necropsy*—Distal part of innominate with origins of subclavian and carotid ulcerated away Sac contained coagula, and a carious, disunited clavicle was involved in it (Mott *New York Medical Repository*, vol 1, 1818 Velpeau American Edition by Mott, 1851, vol 11, p 206 Poland, vol xv, p 76, xvii, pp 88 and 117 (Case 99)—W Thomson)

2 GRAEFE, 1822—Sailor, aged thirty years, admitted to Berlin University Clinique in autumn of 1821 with a subclavian aneurism of rapid growth Operation, March 15, 1822 Incision along anterior edge of sternomastoid Innominate ligatured one inch from aortic arch Suppuration Ligature came away on fourteenth day When wound was nearly healed, repeated hæmorrhages, to which patient succumbed on sixty-seventh day Fatal result contributed to by suppuration in sac, which was incised *Necropsy* showed innominate plugged by clot (Graefe and Walther *Journal*, 1822, Band iii, Heft 4, p 599 Ditto, 1825, Band iv, Heft 3, p 587 *Medical and Physical Journal*, London, 1823, p 475 Poland, xv, p 76, xvii, p 125 (Case 100)—W Thomson)

3 GEORGE NORMAN, 1834 Bath—The only account is that given by Gore in 1878 in the report of his own case (12) "More than fifty years ago a similar operation was performed in this city (Bath), followed by death on the fifth day But in that instance, although the case was in many respects favorable, the operation was overlong delayed, and was at last undertaken somewhat hastily and unadvisedly owing to the occurrence of a train of symptoms, the true character of which was altogether misunderstood and misinterpreted They were, in fact, the signs of an attack of acute pericarditis, which was a sufficient cause of death The state of parts about the seat of ligature as seen after death was very satisfactory and promising, as there was a firm clot on the cardiac side and no signs of suppuration in the mediastinum"

Mr C Noel Davis, House Surgeon, Royal United Hospital, Bath, has very kindly searched the hospital records for me, but has been unable to find any notes of this case The specimen is in the hospital museum The catalogue notes state that the case was one of aneurism of the right subclavian in a male patient. (Gore *Lancet*, London, 1878, vol 11, p 119 Poland, xv, pp 76 and 126 (Case 101) Ferguson's Surgery, Philadelphia, 1845, p 429 Erichsen's Surgery, fourth edition, p 645)

4. ARENDT, 1827—J L, countryman, aged thirty-six years, admitted to Iwanhoff Hospital, St Petersburg, December 3, 1827 Blow on right shoulder a year previously, followed by swelling, which subsided, to reappear six weeks before admission Subclavian aneurism Operation on or about December 24 Incision along inner edge of sternomastoid, innominate ligatured Suppuration Death on eighth day from "exhaustion" *Necropsy*—Puriform infiltration of parts Inflammation of right lung

Ligature had cut through inner coats of innominate Sac contained grumous blood and fibrous lamellæ Effused lymph on brain Liver large and soft (Dietrich's Collection, p 188 Poland, xv, p 76, xvii, p 126 (Case 102) )

5 J HALL, 1830—H J, aged fifty-two years, laborer, admitted to Baltimore Hospital, 1830 Tumor above right clavicle since "first months" of 1830 Aneurism of subclavian Ligature of innominate, September 7, artery diseased with adhesions round it, bleeding followed separation of adhesions, requiring compression Artery tied, bleeding recurred, wound plugged and operation terminated On September 10 patient got up and walked about Bleeding from wound, September 11 Death, September 12, fifth day from operation *Necropsy*—Wound foetid Ligature had been carried through the coats of the innominate, making two holes Dense clot in sac (*Baltimore Medical and Surgical Journal and Review*, 1833, vol 1, p 125 Poland, xv, p 76, xvii, p 127 (Case 103) —W Thomson )

6 W BLAND, 1832—J M, male, aged thirty-one years, admitted to Benevolent Asylum, Sydney, New South Wales, March, 1832 Throbbing tumor above right clavicle for two years Ligature of innominate, March 26, 1832 Incision in direction of fibres of right sternolaryngeal muscles, with separation of their fibres, also division of sternal head of sternomastoid Ligature, "consisting of two threads," tied so as to divide inner coats Patient got up April 1 Discharge from wound "creamy" Hæmorrhage, seventeenth and eighteenth days Death eighteenth day *Necropsy*—Innominate and carotid plugged with clot Innominate nearly divided by ligature which remained around vessel Hæmorrhage from subclavian distal to ligature

In his remarks upon the case (in the postoperative treatment of which there were numerous venesections), Bland regrets that he did not bleed with a more *liberal hand* (*Lancet*, London, vol 1, 1832-1833, October 20, p 97 Poland, x, p 76, xvii, p 128 (Case 104) —W Thomson )

7 BUJALSKY, 1833—W M, male, aged fifty-six years Patient in Military Hospital, St. Petersburg Aneurism of right subclavian Tumor large, extending from armpit to edge of inferior maxilla, apex covered by red skin, clavicle divided into two parts Ligature of innominate, March 11, 1833 Vessel tied after the rules laid down by Bujalsky in "Tabulæ Anat-Chirurg," the artery being tied by means of a "tourniquet" (und unterband die arterie anonyma mittels des von mir erfundenen tourniquet) Incision extended almost to inner margin of sternomastoid Operation difficult owing to scars in the neck from old scrofulous glands Subsequently shivering, heat, and rapid pulse Death on March 16, fifth day after operation *Necropsy*—Aneurismal dilatation of heart, aorta, and arch of aorta Pus in pericardium and left pleura (*Kriegs Medicinische Zeitung*, 1833 "Tabulæ Anatomico-Chirurgicæ Ligandarum Arteriarum Majorum Exponentes," St. Petersburg Elephant Folio, 32 pp, 14 plates Reference in Medical and Surgical History of the War of the (American) Rebellion Surgical volume, part 1, p 537 These Inaugurale de M Beistigni, Paris, 1841 (communication from Velpeau) Poland, xvii, pp 88 and 92—W Thomson )

8 BUJALSKY, 1833 ? (second case) —Subclavian aneurism probably No details obtainable Death shortly after operation (References as under 7)

9 A PARIS SURGEON, 1834 —Case mentioned by Dupuytlen Hæmorrhage Death on third day (Dupuytren Leçons Orales de Clinique Chirurgicale, p 611, Paris, 1834 —W Thomson Poland, xv, p 78, xvii, p 88 (Case 106) —Souchon)

10 LIZARS, 1837 —Case first described in the "Caledonian Mercury" of June 1, 1837, by an enterprising reporter, who was attracted by the crowd entering the Royal Infirmary to witness the operation A D, aged thirty years, carter, admitted to Royal Infirmary, Edinburgh, May 28, 1837 Subclavian aneurism, size of small egg Falls on right shoulder, fifteen and eleven months previously, on second occasion fracturing clavicle, cramps and tingling in right arm, six to seven weeks Innominate ligatured May 31, incision along inner border of sternomastoid, right sternolaryngeal muscles cut across, both ends of ligature cut short Pulsation returned in aneurism, but disappeared in twenty-four hours, wound suppurated, knot of ligature came away seventeenth day, hæmorrhages, death, twenty-first day *Necropsy* —Hæmorrhage into right side of thorax Innominate "separated" near ligature at seat of hæmorrhage Sac of aneurism collapsed and full of coagula (*Lancet*, London, 1837, vol 11, pp 441, 445, 602 Poland, xv, p 78, xvii, p 132 (Case 105) )

11 HUTIN (Paris), 1842 —N C, aged twenty-seven years, soldier, fighting a duel at Oran, wounded in right axilla by scissor-blade tied to end of a stick Hæmorrhage, arrested by plugging wound, but recurred fourth to twelfth days Third part of subclavian tied on twelfth day Eighteenth day, hæmorrhage from axilla Twenty-first day, subclavian ligature came away, followed by further hæmorrhage, innominate artery tied at midnight, flat ligature with an additional "ligature of reserve" Patient died eleven hours later *Necropsy* —Ligature had been properly applied Original hæmorrhage from inferior thoracic branch of axillary (*Lancet*, London, 1841-1842, vol 11, p 230 —W Thomson Archives de Chirurgie Française et Étrangère Poland, xvii, p 137)

12 R. T GORE, 1856 —D D, male, aged fifty-two years, baker, admitted to Bath United Hospital, September 22, 1856 Aneurism in axilla and root of neck of three years' duration, more prominent when patient lies down Innominate tied under chloroform, September 24 Mott's incision, hempen ligature used Slight erysipelas, fifth day, phlebitis right arm and left leg, eleventh day, suppuration, rigors, cough, arterial hæmorrhage on October 10 (seventeenth day), causing death in an hour *Necropsy* —Innominate partly cut through by ligature Innominate and carotid plugged by clot. Aneurism filled with a firm coagulum Pus in anterior mediastinum (*Lancet*, July 27, 1878 Poland, xv, p 78, xvii, p 136 (Case 109) )

13 PIROGOFF, St Petersburg, 1856 —Male, aged forty-six years Right subclavian aneurism, occupying the site of an old abscess Ligature of the innominate. Cough, râles in chest, paralysis of left side of face, death in forty-eight hours *Necropsy* —Acute inflammation of arterial



sheath and around ligature, pleurisy, purulent mediastinitis, oedema of lungs, pneumonia, extravasated blood over both hemispheres (Allgemein Kriegs Chirurg, 1864, p 459 Poland, xv, p 78, xvii, p 137 (Case 110) )

14 COOPER, San Francisco, 1859—Male patient Two aneurisms, one at root of subclavian, the other at root of carotid, united by adhesions Incision, Mott's modified, with removal of summit of sternum and sternal end of clavicle Innominate dilated by aneurism and ligatured within three-quarters of an inch of the aorta After five days, restlessness, dyspnoea, retention of urine Death on ninth day *Necropsy*—Pus in right kidney, no mention of condition of aneurism or of seat of ligature (*American Journal of the Medical Sciences*, N S, vol xxxviii, 1859, p 395 Poland, xv, p 78, xvii, p 135 (Case 107)—W Thomson )

15 COOPER, San Francisco, 1860 (second case)—Disease not stated, probably aneurism Upper part of sternum and sternal end of clavicle removed Ligature of innominate Hæmorrhages, arrested by compression Patient removed the bandages and allowed himself to bleed to death on the thirty-fourth day Hæmorrhage believed to be from distal end (*San Francisco Medical Press*, January, 1861 *Gaz Hebdom*, 1861, p 612 Poland, xv, p 78, xvii, p 135 (Case 108)—W Thomson, W G Spencer )

16 A W SMYTH, 1864—W M, mulatto, aged thirty-three years, steamboat steward, admitted at New Orleans Hospital, May 9, 1864 Aneurism of right subclavian dated from a collision of patient's ship in February, 1864, when he hung from an anchor with another man clinging to him Small throbbing tumor noticed a month later, which gradually enlarged Operation, May 15 Mott's incision Ligature of the innominate quarter of an inch from the bifurcation and of the carotid Ligature came away from carotid on May 28 and from innominate on June 2 Hæmorrhages on May 29, 30, and 31, lint packing Wound filled with small shot on June 1 Some shot removed June 17, return of hæmorrhage Further hæmorrhages, and on July 5 "terrific hæmorrhage," which ceased spontaneously July 9, ligature of vertebral, all shot removed following day, complete recovery May, 1869, no vestige of aneurism June, 1874, aneurism recurred and became larger than at first October 5, internal mammary tied, some improvement (?) Abscess above clavicle opened March 29, 1875, two days later aneurism ruptured into cavity of abscess, sac laid open and stuffed with lint, mouth of supplying vessel not found Death, April 6, 1875 *Necropsy*—(Arteries injected) Innominate had been tied less than an inch from its origin, fibrous tissue beyond Carotid occluded to its bifurcation and subclavian to within quarter of an inch of thyroid axis, which, with its branches, was pervious Vertebral occluded to fourth cervical vertebra (*American Medical Times*, vol ix, 1864, p 95, August 20 *American Journal of the Medical Sciences*, N S, vol lii, 1866, p 280 Sydenham Society's Biennial Retrospect, 1865-6, p 646 Smyth Report of the Successful Ligature of the Innominate, the Common Carotid, the Vertebral and the Internal Mammary Arteries, New Orleans, 1876—W Thomson *Dublin Jour Med Sci*, 1876, third series, vol liii, p 482 Poland, xv, p 78, xvii, p 141 (Case 111)—Souchon )

17 LYNCH, New York, 1867—Gunshot wound of the internal carotid and vertebral arteries Ligature of the innominate for secondary hæmorrhage, the common carotid having been tied a month previously Hæmorrhage on twelfth day and the patient died soon after *Necropsy*—Partially organized clots in cardiac end of innominate (*Medical Gazette*, New York, 1868, vol 1, p 100—W Thomson)

18 E R BICKERSTETH, 1868—J J, aged forty years, dock porter, admitted to Liverpool Royal Infirmary, April 15, 1868 Subclavian aneurism size of a hen's egg, attributed to a strain in lifting three weeks previously Operation, May 5 Mott's incision, specially made lead wire clamp, with screw for tightening, applied round the innominate On May 7 pulsation returned in the aneurism and the lead wire was found to be broken Clamp removed and vessel tied with silk above and below where the wire had been Suppuration Hæmorrhage from the wound, May 13 and 14 Shot poured into wound Death, May 14, seventh day after ligature *Necropsy*—Clot in aneurism and in innominate from aorta to point of ligature Hæmorrhage from "the distal side of the upper" ligature (*Medico-Chirurgical Transactions*, vol lvi, 1873, p 129 *Lancet*, London, December 7, 1872, p 815)

19 A B MOTT, New York, 1868—Male patient Subclavian aneurism Operation, August 13, 1868 Innominate and carotid tied Ligature came away on twentieth day, hæmorrhages, death on twenty-third day *Necropsy*—Hæmothorax, sac ruptured into pleural cavity (Wyeth *Trans Amer Med Association*, vol xxix, 1878, p 168—W G Spencer)

20 S B PARTRIDGE, 1870—R C, a native hawkier, admitted to Medical College Hospital, Calcutta, April 17, 1870 Aneurism of right carotid of one and a half years' duration Common carotid tied below omohyoid Ligature separated on May 2, thirteen days after operation, on same day patient feverish and coughing, and at 10 P M sudden gush of arterial blood from wound, innominate ligatured just below bifurcation, patient died one and a half hours later (*Indian Annals of Medical Science*, vol xiv, p 222—W Thomson)

21—E S O'GRADY, Dublin, 1873—Patient, a cabinet-maker, work entailed considerable strain on right shoulder Large aneurism of three years' duration in axilla and above clavicle Operation, inner two inches of clavicle removed, carotid and innominate tied Death in twenty hours *Necropsy*—Serous effusion into cerebral ventricles (Power *Anatomy of the Arteries*, third edition, by W Thomson, p 49—W Thomson)

22 G BUCHANAN, 1880—T W, aged forty years, stone-dresser, admitted to Western Infirmary, Glasgow, April 19, 1880 Tumor right side of neck for four months, large subclavian aneurism with inflamed skin over it Potassium iodide and morphia given May 14, galvanopuncture Subsequently, repeated bleedings from needle punctures and great increase in size of tumor, so that it pressed on larynx and trachea June 1, sharp hæmorrhage and large clot noted, forming a projection covered by thin skin which had given way in two places Bleeding stopped spontaneously Operation same day, incision in line of carotid and transversely across tumor, gush of arterial blood stopped by pressure

Sac had burst before operation, rent found in vessel at bifurcation of innominate, innominate ligatured Patient died in a few minutes (*Glasgow Medical Journal*, fourth series, vol xiv, 1880, p 152)

23 W THOMSON, 1882—J M, aged forty-nine years, locksmith, admitted to Richmond Surgical Hospital, Dublin, February 7, 1882 Never had syphilis, fairly temperate, had fought in the American Civil War Pains in right arm two and a half years, tumor in neck two months, aneurism of second and third parts of subclavian Left hospital Readmitted, May 22 Operation, June 9 Mott's incision, innominate tied with flat (ox aorta) ligature, secured with three knots, drawn with moderate firmness After-progress at first good Drainage-tube removed on the seventh day, and a few strands of catgut substituted for it Suppuration, hæmorrhage on thirtieth and thirty-ninth days, death on forty-second day *Necropsy*—Drainage-tube sinus had become septic, producing ulceration on anterior face of innominate distal to ligature, from this place hæmorrhage had apparently taken place Aneurism full of clot, inner coats of innominate not divided, and vessel not occluded, a "chink" remaining, no trace of ligature (*Brit Med Jour*, 1882, vol 11, p 722 *International Encyclopædia of Surgery*, vol 111, p 538—W Thomson)

24 W M BANKS, 1883—J B, aged fifty years, male, admitted to Liverpool Royal Infirmary, February 10, 1883 Aneurism of third part of subclavian Rest, etc, tried without good effect, and on February 26 innominate and carotid tied through Mott's incision, kangaroo tendon ligatures used, and tied with a force thought sufficient to occlude artery without damaging coats Pulsation in aneurism returned same evening, and remained Wound healed and patient went out on twentieth day Readmitted, and sixty-seven days after first operation first part of subclavian tied with great difficulty, a double catgut ligature being used Sepsis, bronchopneumonia, hæmorrhage from wound thirty-first and following days, patient died thirty-seventh day On fourth day, aneurism small, hard, and free from pulsation *Necropsy*—Innominate patent. (Jacobson *Brit Med Jour*, 1885, vol 1, p 230 *Proc Royal Medico-Chirurgical Society*, N S, vol 1, p 232—W G Spencer)

25 BULL, New York, 1884—Subclavian aneurism Innominate, carotid, and vertebral simultaneously ligatured with double catgut ligatures Death on thirty-third day from hæmorrhage—(Burrell)

26 BENNETT MAY, 1886—J N, aged thirty years, brewer's laborer, admitted to Queen's Hospital, Birmingham, March 3, 1886 For years great exertions and violent straining, particularly of right shoulder, which has been dislocated three times No syphilis Moderate drinker Shooting-pains and numbness down the arm for seventeen months, swelling above clavicle nine weeks Aneurism of subclavian extending under sternomastoid Rest, Tufnell's diet, and potassium iodide No improvement, and patient not willing to continue the treatment Operation, March 27 Innominate tied through Mott's incision, ox aorta ligature broke, so five or six strands of medium-sized catgut used and tied as one ligature, secured with three knots, endeavor made to avoid crushing coats of artery, wound drained Pulsation returned in aneurism the following

day, hæmorrhage from wound, April 10 and following days, suppuration, death, April 14, eighteen days after the operation *Necropsy*—Large aneurism, which had eroded vertebræ, and occupied all three stages of the subclavian artery Knot of ligature very large and hard, and under it a hole in the artery, from which the hæmorrhage had taken place, inner coats otherwise intact (*Lancet*, London, 1886, vol 1, p 1064)

27 DURANTE, 1887—G S, employe, aged forty-five years, admitted to Durante's Clinique, Rome, March 20, 1887 Tingling and pain in arm for two years Tumor above clavicle one month Aneurism between scaleni Operation, March 25 Ligature of innominate, carotid, and vertebral through Mott's incision Drainage-tube left in until April 3 Sepsis, right hemiplegia, hæmorrhages commencing April 6, death fifteenth day (April 9) *Necropsy*—Aneurism collapsed and containing coagula, embolic softening of left caudate nucleus (W G Spencer *Lancet*, London, April 30, 1887, p 876 Sajous *Journal*, 1888, p 251—Souchon)

28 J LEWTAS, 1889—Patient, a soldier, aged twenty years, in Murdan Hospital, Punjab, India A month before operation his gun burst, and he thought that a piece of the breech lodged above the right collar-bone, bleeding from the wound there for three days before admission Hard, non-pulsating swelling above clavicle, with brownish blood oozing from partly healed wound in its centre, thought to be an abscess Operation, May 13 Wound enlarged and fragment of steel removed, profuse hæmorrhage, stopped by pressure, incision along inner margin of sternomastoid, innominate and carotid tied with catgut Recovery The operator remarks that, had he known how unfavorable the results of operation were, he would have contented himself with plugging the wound (*Brit Med Jour*, 1889, vol 11, p 312)

29 G E TWYNAM, 1889—E P, female, aged eighteen years, admitted to Prince Alfred Hospital, Sydney, New South Wales, having one month previously (on July 21, 1889) been thrown from a horse, fracturing the right clavicle and bruising the right shoulder Boggly swelling formed above clavicle, which increased in size, pulsation, much pain Operation Central incision and separation of sternolaryngeal muscles, innominate and carotid tied with silk, wound closed without drainage Following morning, about 9 A M, patient suddenly became unconscious with left facial paralysis, and died in an hour *Necropsy*—Wound only examined Sac contained coagula and communicated with first part of subclavian by a rounded aperture, inner coat of innominate completely ruptured by ligature, no distal plug of blood-clot in innominate or carotid Cause of death uncertain, as brain was not examined Twynam suggests thrombosis of cerebral veins (*Lancet*, London, 1890, vol 1, p 1352)

30 W H A JACOBSON, 1890—A H, gamekeeper, aged forty-eight years, admitted to Guy's Hospital, London, February 10, 1890 Large aneurism in axilla and above clavicle Swelling noticed a year before Ligature of the innominate and carotid through Mott's incision, with removal of the inner end of the clavicle, ox aorta used for ligature material, and tied so as to close vessel without injuring coats, drainage-tube inserted Pulsation ceased in aneurism and never returned Rest-

lessness, delirium, and bronchopneumonia, died, exhausted, on tenth day after operation *Necropsy*—Large aneurism of second and third parts of subclavian, filled with clot, remains of ligature loose, round innominate, but no knot found, drachm of "quite sweet puslike fluid" surrounding bifurcation of innominate, bronchopneumonia of both bases, valvular disease of heart, atheroma of aorta, early nephritis Brain normal (Jacobson)

31 C COPPINGER, 1893—Man, aged fifty-three years, admitted to Mater Misericordiæ Hospital, Dublin, December 5, 1892, with aneurism of the second and third parts of the subclavian and aneurismal dilatation of the axillary artery Operation, January 9, 1893 Ligature of innominate and carotid through Mott's incision, silk used, carotid tied in two places and divided, strict antiseptic precautions On third day, when dressings were removed, no pulsation in aneurism Patient shown at meeting of British Medical Association at Newcastle-on-Tyne in August, 1893, good health, strong and useful right arm, no pulse at right wrist, small, hard swelling above clavicle On July 4, 1895, patient was seen at St. Bartholomew's Hospital, London, and was then quite free from any trace of his aneurism (Letter from Dr Alfred Willett to Dr Coppinger) (*Lancet*, London, vol 11, 1893, p 327 Trans Roy Acad Med, Ireland, vol xi, 1893, p 243 *New York Medical Journal*, April 8, 1893—Souchon)

32 C J SYMONDS, 1894—G M, aged fifty-three years, male, admitted to Guy's Hospital, London, October, 1894, with subclavio-axillary aneurism Operation, November 5, 1894 Attempt first made to ligature first part of the subclavian through a vertical incision over the sternomastoid, but sharp hæmorrhage occurred on attempting to pass the needle round the artery, thought that some branch of thyroid axis was injured Mesial vertical incision made and the two vertical incisions joined by a transverse one above the clavicle, the sternal head of the sternomastoid being divided, innominate and carotid tied with silk Two sinuses formed after operation, through which catgut and one piece of silk came away Patient seen in June, 1895, aneurism hard, usefulness of limb returning, no pulse in radial, pulse in carotid above ligature In response to an inquiry, Mr Symonds kindly writes on October 1, 1904, "The man died some time ago of a general malady"—(Jacobson)

33 H L BURRELL, 1895—R. F, male, aged fifty-four years, a clerk, patient in Boston City Hospital "Lump in throat" for eighteen months Pulsation in vessels of right side of neck with expansive thrill and bruit, undue pulsation in various other arteries, heart systolic and diastolic murmurs Operation, January 15, 1895 Ether Mott's incision, with removal of sternoclavicular articulation and adjacent portion of sternum, innominate found much dilated (estimated diameter one and one-quarter inches), ligatured with flat, braided-silk tied in a "square (reef) knot," knot tied slowly, coats of the vessel felt to give way, second similar ligature placed half an inch distally to the first (first ligature to act as "breakwater"), wound closed without drainage Primary wound healing, pulsation ceased in aneurism, pulse returned in radial but not in carotid, patient got up on the fifty-ninth and left hospital on

the seventy-third day Subsequently, œdema of feet and heart trouble Died suddenly from heart failure on the one hundred and fourth day after operation *Necropsy*—Hypertrophied and dilated heart, chronic congestion of lungs, liver, spleen, and kidneys, old pleurisy, ascites, general arteriosclerosis, circumscribed dilatation (fusiform aneurism) of right subclavian, of innominate and of right iliac, innominate had been occluded by distal and severed by proximal ligature, the latter ligature being found inside the artery, the lumen of which had been restored, chronic interstitial orchitis (indicating syphilis) —(Burrell)

34 B FARQUHAR CURTIS, 1899—M A, aged fifty-three years, carpenter, admitted to St. Luke's Hospital, New York, November, 1899, with subclavio-axillary aneurism Symptoms of some months' duration Rest, limited diet, and potassium iodide improved the condition of the arteries and moderated the heart's action Ligature of the innominate, December 2, 1899 Median incision, separation of sternolaryngeal muscles, splitting of manubrium sterni in middle line, transverse division of sternum above second rib Innominate much dilated, but with apparently healthy walls, ligatured with a double heavy chromicized catgut ligature, the two threads being tied simultaneously, internal coats not divided, single similar ligature put round vessel a quarter of an inch distally to the first, wound closed with gauze drainage Some sepsis and slow wound healing, no hæmorrhage, pulsation returned in the aneurism four days after the operation

March 13, 1900 Second operation Carotid and first part of subclavian tied, the clavicle being divided and wired Innominate impervious, pulsation in sac came from some branch of first part of subclavian Some sepsis followed, attributed to difficulty in sterilizing rough and wrinkled skin of patient On October 24, 1900, patient in good health, with no trace of the aneurism Dr Curtis kindly writes that "patient was kept under observation for eleven months, when he was well and apparently cured of his aneurism"—(ANNALS OF SURGERY, October, 1901)

35 C A BALLANCE, 1902—Patient, a royal marine, aged thirty-five years, admitted to St Thomas's Hospital, London, March 27, 1902 Exposed to syphilitic infection and had gonorrhœa in 1885 Pain in neck and cough for six months, swelling in neck for three months Treated for a period before admission by rest, reduced food and drink, and large doses of potassium iodide, but swelling continued to increase in size Large aneurism involving innominate and origins of carotid and subclavian, dulness under right upper part of manubrium Operation, April 15, 1902 Median incision, separation of sternolaryngeal muscles, manubrium bisected vertically, horizontal division of sternum at level of second costal cartilages, half an inch of bone removed on each side of vertical bone incision, about half an inch of undilated innominate found between aneurism and aorta, vessel tied in a "stay knot" with four strands of No 4 goldbeaters' skin, carotid also tied Patient developed left hemiplegia on the afternoon of the day of operation, and died in the evening *Necropsy*—Thrombosis of right middle cerebral artery, aneurism of innominate, origin of carotid, and first and second parts of subclavian,

ligature held walls of innominate in contact without rupture of coats The author thought that the cerebral thrombosis was contributed to by the debilitated condition produced by the Valsalvan treatment (*Lancet*, London, 1902, vol 11, November 1, p 1180)

### CASES OF ATTEMPTED LIGATURE, ETC

1 W H PORTER, Dublin, 1832—Male, aged forty-seven years, laborer Very large subclavian aneurism of two and one-half years' duration Attempt to find a healthy portion of innominate failed, operation abandoned, wound suppurated Subsequently, pulsation diminished, and finally ceased in tumor Porter, seven years later, wrote that the tumor had entirely disappeared, and he believed the patient to be alive and well (*Dublin Journal*, 1832, vol 1, p 25 Poland, xv, p 66, xvi, p 68, xvii, p 99 (Case 62) )

2 HOFFMAN, New York, 1839 (Case also described by Post)—Negro, aged sixty-three years Aneurism of subclavian of five months' duration Operation, October 26, 1839 Innominate too diseased for application of ligature Death from exhaustion three months later *Necropsy*—Atheroma of aorta and innominate, two aneurismal sacs on subclavian artery (Catalogue of Pathological Cabinet, New York Hospital Museum, p 288 (or 258?) (Prep 630) Poland, xv, p 68, xvi, p 71 (Case 64) Gross Surgery *New York Journal of Medicine*, No 4, p 370 (Post) )

3 ASTON KEY, 1844—Married woman, aged forty-six years, admitted to Guy's Hospital, London, April 25, 1844. Aneurism of right subclavian of three months' duration Attempt to tie innominate failed Hæmorrhage from wound on seventh day Sac enlarged, pressing on trachea Death from dyspnœa, twenty-fifth day *Necropsy*—Atheroma of aorta, small aneurism of descending thoracic aorta, aneurisms of innominate and subclavian, vessel remaining of its normal caliber between the scaleni, death apparently from pressure on trachea (Crisp, p 206 Poland, v, p 66, xvi, p 70 (Case 63) )

4 ANTONIO JOSE PEIXOTO, 1851—Patient, Dr J A de Moura, a Portuguese, aged thirty-three years In 1832 developed vascular tumor of right ear, which increased in size "Bleeder" symptoms Posterior auricular artery tied by Nelaton in 1845 On November 14, 1851, common carotid tied in Rio Janeiro, hæmorrhage from wound on December 4 and 7, "*ligature d'attente*" passed under innominate on December 8, no further bleeding, so the ligature was withdrawn on December 13, without being tied Cure complete in two months (Poland, xvii, pp 89 and 92 W Thomson Koch (Case 129) *Memoires de l'Academie Imperiale de Medicine*, vol xix, 1855, p 23 *Amer Med Jour*, January, 1857, vol xxxiii, p 255 *British and Foreign Med Review*, October, 1856, vol xviii, p 353 )

5 G H PORTER, 1867—P G, aged forty-three years, laborer, admitted to Meath Hospital, Ireland, June 11, 1867 Aneurism of subclavian of fourteen months' duration June 26, acupuncture of axillary continued for fifty-three hours, no permanent improvement July 31, innominate

## CASES OF ATTEMPTED LIGATURE, ETC

No	Operator	Place and Date of Operation	Sex and Age of Patient	Disease and its Duration	Procedure	Result
1	W H Porter	Dublin, 1832	Male, 47	Subclavian aneurism, 2½ years	Attempted ligature	Innominate unhealthy, sepsis, recovery
2	Hoffman	New York, 1839	Male, 63	Subclavian aneurism, 5 months	Attempted ligature	Innominate unhealthy, death 3 months later
3	Aston Key	Guy's Hospital, London, 1844	Female, 46	Subclavian aneurism, 3 months	Attempted ligature	Sac large, hæmorrhage, death, 25th day
4	Antonio José Peixoto	Rio Janeiro, December 8, 1851	Male, 33	Vascular tumor of ear, 19 years	Ligature passed but not tied	Recovery
5	G H Porter	Meath Hospital, Ireland, July 31, 1867	Male, 43	Subclavian aneurism, 14 months	Clamp used	Death, 10th day, sepsis, hæmorrhage
6	T Annandale	Royal Infirmary, Edinburgh, May 27, 1885	Male, 53	Subclavian aneurism, 13 months	Clamp used	Death, 12th day, sepsis, hæmorrhage
7	Communicated by E Soucon	Charity Hospital, New Orleans, 1894			Attempted ligature	Innominate unhealthy



laid bare and compressed between the blades of an instrument something like a lithotrite, one blade being passed under the artery and the other made to slide down on it. Pulsation ceased, but returned next day, instrument screwed tighter, but pulsation only temporarily arrested, removed next day (August 2) Hæmorrhage from wound on August 9 and 10 Death, August 10 (tenth day) *Necropsy*—Sloughy aperture on anterior surface of innominate just below bifurcation, artery had evidently partly slipped from between blades of compressor, which were too short (*Dublin Quarterly Jour of Med Sciences*, vol xlv, November, 1867 Poland, xvi, p 63, xvii, p 101 (Case 55) *Medical Press and Circular*, Dublin, 1877, pp 8 and 131—W Thomson)

6 T ANNANDALE, 1885—J B, male, aged fifty-three years, admitted to Royal Infirmary, Edinburgh, May 14, 1885 Aneurism of second and third parts of subclavian of thirteen months' duration Had been treated in the Infirmary about a year previously by rest, dieting, and potassium iodide without any effect on aneurism Aneurism attributed to a strain No history of syphilis Operation, May 27 Innominate exposed through a "median cervical incision," specially designed compressor applied to artery and found to be efficient in stopping the circulation, compressor removed and piece of half-inch india-rubber drainage-tube adjusted, so that one end of it lay behind the artery while the other protruded from the external wound (The idea was subsequently to use the compressor, slipping its small blade into the drainage-tube) Wound healed except where drainage-tube was inserted Hæmorrhage from wound on eleventh and twelfth days, attempt to ligature innominate on latter day failed, so the compressor was applied, stopping the bleeding Death five hours later (*Lancet*, London, vol 1, 1886, March 13, p 481)

7 E SOUCHON, 1894—In a personal letter to Burrell, Souchon speaks of a case in the Charity Hospital, New Orleans, in which the innominate was exposed by removal of part of the sternum, but not ligatured, because it was found so greatly enlarged—(Burrell)

6 *Commentary*—The number of cases in which the innominate has been approached by operation with a view to its obliteration is 43 In 36 of these ligature was accomplished, 28 dying, 8 recovering, a mortality of 78 per cent Subtracting the cases in which the patients were moribund at the time of operation or died a few minutes after operation, viz, Hutin's (11), Partridge's (20), Buchanan's (22), and probably also Bujalsky's second case (8), 32 cases are left with 24 deaths, a mortality of 75 per cent Omitting all cases prior to 1871, *i e*, prior to the antiseptic period, a total of 16 cases is left (O'Grady's to Sheen's) with 9 deaths, a mortality of 56, 25 per cent Of the last six cases operated on, five recovered

Fatal Cases (1) *Sepsis and Hæmorrhage*—Thirteen out of the 24 deaths were certainly due to suppuration in the wound causing secondary hæmorrhage (Cases 1, 2, 6, 12, 15, 17, 18, 19, 23, 25, 26, 27) Two other cases died of hæmorrhage, in one (Hutin, 11) there was direct injury to the artery, in the other (Dupuytren, 9) the cause is not stated Hæmorrhage commenced as early as the third day (9) and as late as the thirtieth day (23) after the operation Hæmorrhage having supervened, death usually occurred in from a few hours to three or four days In Gore's case (12) the hæmorrhage was so furious that death resulted within an hour of its appearance, while in Thomson's case (23) life was prolonged to 12, and in V Mott's case (1) to 17 days after the appearance of the hæmorrhage In some cases hæmorrhage commenced at the time of extrusion of the ligature, in others not until some days afterwards Death occurred as early as the third day (Dupuytren, 9) and as late as the sixty-seventh day (Graefe, 2) after the operation The latter case teaches us that the risk of hæmorrhage does not cease for a long time, and is present at least as long as there is any discharge from the wound In two cases (Thomson, 23, Durante, 27), probably in others, sepsis and hæmorrhage were contributed to by the use of a drainage-tube Bennett May attributes the hæmorrhage in his case (26) to the large hard knot eroding the artery Hall's (5) is an isolated case In Jacobson's case (30) the "drachm of sweet pus-like fluid" round the innominate bifurcation suggests the possibility of sepsis and hæmorrhage had the patient survived In almost all these cases there was an ulcerative arteritis at the site of ligature leading to perforation In one or two the perforation seems to have been produced adjacent to the deep end of a drainage-tube

(2) *Sepsis*—This alone caused death in three cases (Arendt, 4, Bujalsky 7, Pirogoff, 13) In all besides the local inflammation there was apparently a condition of acute septic intoxication, and death occurred early, in from two to eight days

(3) *Cerebral Lesions*—Three deaths were due to this

cause, the exact lesions being various (O'Grady, 21, Twynam, 29, Ballance, 35) In several other cases cerebral symptoms were present, and in two (Pirogoff, 13, Duante, 27) cerebral lesions were found after death

(4) *Other Causes of Death*—There remain only three cases to put under this heading Norman's (3), acute pericarditis, Cooper's first case (14), pus in right kidney, both scantily recorded, and Jacobson's case, bronchopneumonia and acute mental disturbance resembling delirium tremens

*Cases of Recovery*—These are eight in number Only one (Smyth's, 16) belongs to the preantiseptic period, being the only case which survived the great danger of secondary hæmorrhage Smyth's and Banks's (24) cases both died of conditions connected with the aneurism, the former 11 years and the latter 104 days after the ligature of the innominate Burrell's case (33) never completely recovered, and died on the 104th day of general arterial and visceral disease Symonds's case died of causes unconnected with the aneurism The cases of Lewtas (28), Coppinger (31), Curtis (34), and Sheen (36) were alive and well when last heard of Coppinger's case is known to have survived the operation two years, Curtis's 11 months, and Sheen's 8½ months Omitting Burrell's case, in four of the remaining seven secondary ligaturing operations were required In only three did the one operation bring about permanent consolidation in the aneurism, the innominate and carotid being simultaneously ligatured in each of the three

*Cases in which the Innominate was cut down upon but not ligatured*—These require little comment A clamp may slip, may injure the artery, and, by necessitating an open wound, is likely to bring about infection The spontaneous recovery in W H Porter's case (1) after suppuration is interesting

*Asepsis*—To induce and maintain asepsis is imperative in ligature of the innominate This should be easy under modern conditions, but one or two special precautions are necessary The preparation of the patient's skin should be com-

menced at least two days before the operation, or even longer when the skin is rough and wrinkled (*cf* Curtis's case), the superficial epithelium being removed by hot boracic fomentations. The anæsthetist should be screened off by a sterile linen sheet after the plan so successful in Kocher's hands in cases of goitre\*. The sterilized cloths should be stitched to the skin close round the wound to prevent their displacement. A drainage-tube should not be used.

*Cerebral Lesions*—At the present time, asepsis being attainable, a study of the cases shows that a fatal result is most to be feared from cerebral complications. To lessen this possibility, I suggest that the operation should be performed in two stages, the carotid being tied about a fortnight before the innominate. The central incision could be used for both operations.

*General and Local Conditions as Factors determining Success*—Marked general arterial disease with accompanying visceral changes is unfavorable, a circumscribed aneurism with good general condition is favorable. Burrell's (33), although in the list of successes, is a typically unfavorable case: the aneurism was less an aneurism than part of a general arterial dilatation, and all the viscera were extensively diseased. In this case the ligature of the innominate being aseptically conducted did not do any harm, but it probably did little good. The innominate at the point of ligature was one and a quarter inches in diameter, or about the diameter of the normal aorta at its origin, whereas, the normal diameter of the innominate is just over half an inch. The ligature then was really put round the aneurism, if one can apply the term aneurism to a general dilatation of the innominate and subclavian. If circumscribed, the actual size of the aneurism does not matter, as shown by Ballance's case, where the sac reached to within half an inch of the aorta.

*Ligature on Failure of Lesser Operative Measures*—

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\* Kocher's "Text-Book of Operative Surgery," translated by H. J. Stiles, 1903, p. 26. Publishers, A. & C. Black, London.

Given asepsis and a circumscribed aneurism with healthy vessel adjacent, there is no reason against ligaturing close up to the aneurism. This, besides with subclavian aneurism being probably the less serious operation, has the advantages of not interfering with the cerebral circulation and of not giving so great opportunities for the collateral circulation to restore pulsation in the sac. Probably in my own case ligature of the second part of the subclavian would have been sufficient to cure the patient, although the aneurism undoubtedly became smaller and harder as a result of the first operation. The usual surgical opinion that ligature of the first part of the subclavian is unjustifiable requires revision. The fatal cases have all been fatal from sepsis and hæmorrhage. Recently, Nassau, of St Joseph's Hospital, Philadelphia, has successfully done the operation on the right,<sup>\*</sup> and Stonham, of Westminster Hospital, on the left side.<sup>†</sup> Curtis's case (34) is a further example of successful ligature of the first part of the right subclavian.

*Mode of Approach*—The central incision is the best. That it is applicable to large aneurisms is shown by Ballance's case. Where circumstances necessitate the opening of the anterior mediastinum, this should be done by longitudinal and transverse division of the manubrium sterni, as fully described by Curtis in his account of his case. Removal of bone is rarely necessary. A powerfully bladed double retractor with screw action, having its handles curved down over the chest, suggests itself as the best instrument for forcing the two halves of the bone apart. The operator works standing on the left side of the patient, near the patient's left shoulder, and looks downward into the wound.

*Material of Ligature*—The ligature material must be certainly sterile and sufficiently strong to withstand the strain to which it is to be subjected. Too much importance has been

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\* Gould's "Year-Book of Medicine and Surgery," 1904, Surgery, p. 231.

† Lancet, London, August 2, 1902.

attached to the question of the best material for ligature, fatal results having been attributed by operators to defects in the ligature when they have really been due to septic infection at the site of ligature. Silk, as being strong and certainly sterilizable, is the best material. Whether floss-silk or Chinese twist does not matter.

*Degree of Tightness of Ligature* *Question of injuring Inner Coats*—Injury to the inner coats becomes a dangerous factor only when in addition to such injury sepsis is present. Even with a diseased innominate, as Burrell's case shows, the inner coat may safely be ruptured. Further, a study of the cases leads one to the conclusion that if the ligature is drawn tight, dividing, to some extent at all events, the inner coats, there is much less probability of pulsation returning in the aneurism. In the accounts of older cases (where one's general knowledge of the material and methods employed leads to the conclusion that in each a silk ligature was used drawn quite tightly) no mention is to be found of return of pulsation in the aneurismal sac, except in one (Lizars), and there it was quite transitory, and the reports of the necropsies indicate consolidation in the sac. In the later cases, on the contrary, where occlusion without rupture of coats was usually aimed at, return of pulsation has been frequent (Banks, Bennett May, Curtis, Sheen), necessitating secondary operations, and, further, the return of pulsation has been early, indicating that it has been due to a direct current of blood through the innominate at the site of ligature rather than to the establishment of a collateral circulation. In Thomson's case, where the innominate was tied with "moderate firmness," a "chink" in the vessel at the site of ligature was found at the necropsy. The experimental work of W. G. Spencer, Delépine, and Dent\* also supports the policy of tight ligature with division of the internal coats. If, however, the operator decides to aim at occlusion without rupture, two or more ligatures lying

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\* Delépine and Dent. *Medico-Chirurgical Transactions*, London, vol. lxxiv, 1891, p. 367.

side by side, and thus occluding the arterial lumen over a certain length (Ballance and Edmunds's method), are obviously better for this purpose than a single ligature

*Kind of Knot*—The first turn of either a reef or a surgical knot is liable to slip before the second turn is applied. In the "stay knot" of Ballance and Edmunds, two or more ligatures are placed side by side, round the vessel, in each is made in the same direction the first turn of a reef knot, then on each side the ends are gathered up together and treated as one strand in making the second turn. This knot is much less liable to slip than the others mentioned, but slipping to some extent is possible, particularly when only two strands are used, the "mutual support by friction and interlocking" not being sufficient to prevent such slipping. The stay knot, in my own case, either slipped, or else—a possibility, I think, unlikely from the force used—was not, in making the first turn, drawn sufficiently tight to close the vessel.

With all these knots the slipping of the first hitch is probably to a large extent brought about by the force of the blood pumped from the aorta. Some "breakwater" method, as Burrell terms it, is best to obviate this. Two strands are passed beneath the vessel if possible, half an inch or more apart. The first turn of a surgical or reef knot is then made in the proximal ligature and tightened, pulsation ceasing in the vessel beyond the tightened turn and in the aneurism. This first turn in the proximal ligature is then held tight, and the force of the pumping blood being thus taken off the part of the vessel encircled by the distal ligature, the latter ligature is completely tied by a surgical or reef knot. Finally, the second turn is taken in the proximal ligature and fixes it. This is a modification of Senn's method, which consists simply in placing two ligatures round the vessel and tying the one on the cardiac side first. Such a method was used in Burrell's and Curtis's cases and in my own for tying the subclavian. That this method is not always successful is shown by the return of pulsation in Curtis's case. The ligature on the cardiac side is liable to slip. Hence the modification that I have suggested

An objection to this modification (not, I think, a great one) is that some part of the procedure has to be intrusted to an assistant. Any method involving two separate ligatures may be inapplicable owing to operative difficulties. I would put in order of preference the methods suitable for occlusion of the innominate after it has been exposed, as follows

- (a) Two separate ligatures tied as described above
- (b) The "stay knot," at least three strands being used
- (c) A single ligature tied in a surgical knot

In all three cases I would draw the ligature so tightly that some amount of damage to the inner coats would be inflicted, this being particularly essential in the last method

## 7 CONCLUSIONS

1 That in properly selected cases ligature of the innominate is a reasonably safe and undoubtedly useful operation

2 That suitable cases are those in which the aneurism is of a circumscribed, globular character, and the general condition of the patient is otherwise good. That unsuitable cases are those in which the aneurism is what is commonly called fusiform, but is really often nothing more than part of a general arterial dilatation, and in which there are marked signs of general arteriosclerosis with accompanying visceral disease

3 That the maintenance of asepsis is the main factor in obtaining a successful result

4 That the incision should be central with horizontal and vertical division of the manubrium, if necessary

5 That the carotid should be tied as well as the innominate

6 That silk is the best ligature material

7 That some amount of injury to the inner coats is probably necessary to insure occlusion, but that with aseptic conditions such injury does not matter

8 That two ligatures should if possible be placed round



the vessel, the first turn of the proximal ligature being held tight, so as to keep back the blood while the distal ligature is completely tied

9 That the use of a drainage-tube is inadvisable

10 That as a study of the recorded cases shows that, next to sepsis, some cerebral lesion has been the most frequent cause of death after operation, it would be well for future operators to consider the advisability of tying the carotid about a fortnight before the innominate

11 That "Valsalvan" methods of treatment immediately prior to operation are inadvisable

## 8 GENERAL REFERENCES

N B—The words in brackets after certain references indicate the shortened form in which such references are given above in the special references after each case

Ballance and Edmunds Ligature in Continuity, 1891

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# THYROIDECTOMY FOR EXOPHTHALMIC GOITRE

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THIS mode of treatment is based upon the following facts

I That " the whole story of Basedow's disease lies in the thyroid gland " (Kummell )

II That " chemically it makes no difference whether the secretion of the gland is increased or is chemically altered as the result of changes in the blood, in the alimentary canal, or in the central nervous system, the fact remains that the removal of the growing gland does away with the symptoms, and upon the failure to remove the diseased glands depends the failures to cure " (Schulz )

III That " the characteristic pathological change in the gland is a diffuse parenchymatous hypertrophy Where goitre is endemic, this condition is engrafted upon it " (Hamig )

IV That " the secretion of the gland in the diffuse parenchymatous hypertrophy is increased in quantity, and is altered in quality " (Hamig, Edwards )

V That the complete removal of the gland rarely fails to show signs of degeneration in the central nervous system, the acute form of which is tetany, the chronic form, cachexia thyreopriva

In several hundred cases, the ultimate results of the removal of the diseased portion of the gland have been more or less imperfectly observed In about 125 cases, this observation has been very carefully made at periods varying from six months to twelve years These cases have been reported by Rehn, Riedel, Mikulicz, Kronlein, Kappeler, Wolff, Kocher, Schulz, and Curtis and Booth

The Mayos have recently reported 34 cases, but with no details

In all cases reported in detail, where sufficient gland has been removed, the pulse-rate has fallen within 48 hours to 80 and 100 beats per minute. The unrest, the fear, the muscular tremor, and the melancholia have been relieved within the first week.

The exophthalmos has been the most difficult to relieve, and has often persisted two years before complete disappearance. I have seen some cases with a slight degree of it after five years.

A return of the symptoms, including the exophthalmos, after partial thyroidectomy has been reported by Mikulicz (3), and Schulz (2) in five cases. In one of these cases a parenchymatous nodule was only removed. In four cases a resection of one lobe was made. In all a second operation was performed, and a large part of the remaining lobe was removed. In Mikulicz's cases no record exists of the simultaneous recurrence of symptoms and the hypertrophy of the remaining lobe.

In one of Schulz's cases, a recurrence of all the symptoms accompanied an increase in size of the middle and opposite lateral lobe. In this case a second operation was performed, and the remaining lateral lobe was removed almost completely. The symptoms diminished immediately. The pulse fell to 90, and the exophthalmos and the nervousness disappeared rapidly. These cases seem to substantiate the fact that the removal of the diseased and growing gland, or at least the removal of a part, and the production of an atrophy of the portion remaining, is necessary to insure complete success.

Two conditions which take place during or just after operation have been of especial interest, namely, tetany and sudden death. Fortunately, these are not common. In one of Schulz's cases tetany occurred upon the fifth day, and was characterized by spasmodic contracture of the muscles of the calf and of the forearm, dysphagia, laryngospasm, and intense respiratory disturbance. The case was a fatal one from sudden syncope. This condition has not occurred in my cases. Sudden death has taken

place in one of my cases during anæsthesia, and at a time when least expected, since the operation was not a difficult one, nor had there been any untoward symptoms from the anæsthesia. Unfortunately, no autopsy was permitted. These sudden deaths have usually occurred under two conditions. In the one, thymic hypertrophy has been present with thyroid enlargement. In the other, no such thymic hypertrophy exists, although the death is equally sudden.

Marié finds that the thymus is always enlarged in congenital myxœdema, often in myxœdema occurring later in life, and sometimes in acromegalia. He has recorded five instances in which it was present in Basedow's disease (Lanz).

Mixed forms of myxœdema, acromegalia, cachexia thyreopriva, Basedow's disease, and the lymphatic-chlorotic constitution (*Status thymicus* Paltauf) are considered as pointing to a single definite lesion, with varieties more or less definitely known by these names (Marié). One of these varieties is the persistence of the thymus gland and the coexistence of the hypertrophied thyroid of Basedow's disease. The operation of thyroidectomy, indeed any operation upon the neck under these conditions, is dangerous because of the danger of syncope from diminished resistance, the result of the dyscrasia. This form of death has occurred six times in 319 cases, *i e*, 1.8 per cent.

So many cases of sudden death have occurred without the objective symptoms belonging to the lymphatic-chlorotic diathesis, and at the same time without the thymic hypertrophy, that we must believe that the resistance of the individual in Basedow's disease is greatly lowered from other causes than the dyscrasia. From a purely clinical stand-point, it seems probable that these sudden deaths are due to over-excitation and exhaustion of the nerve centres (heart and respiratory), induced, it may be, by an auto-intoxication from the hypertrophied thyroid gland. The death in my case was probably of this nature.

Medicinal treatment should precede surgical interference because of the undoubted cures which have taken place. This

treatment may be combined with the use of the X-ray (Mayo), or with the administration of milk or serum from thyroidectomied goats, sheep, etc (Lanz and Moebius) This method of treatment should not be continued too long, unless operative treatment is absolutely contraindicated, since the disease itself tends to diminish the vital resistance and to exhaust the nerve centres It has been my experience that the earlier the diagnosis and the operation the easier the operation, and the less dangerous and difficult the after-treatment I have found that in the severer types great benefit is derived from medicinal treatment, combined with rest in bed for two to three weeks previous to operation The nervous excitation, the tachycardia, and the muscular tremor are so much improved that operation is often undertaken under much more favorable conditions In the acutely progressing types of this disease, some have proposed an immediate operation because of their resemblance to acute intoxications The advisability of such a procedure I am unable to substantiate, since it has never been my privilege to meet these types

Early operation is, however, indicated in all cases as soon as medicinal treatment fails The operation should not be reserved for the severer cases The earlier the operation the better the condition of the patient to withstand the ordeal, and the less distressing the after-treatment

The early operation is especially indicated where Basedow's disease is engrafted upon a colloid goitre

All of my cases have been operated upon with ether or gas and ether This has been preceded in some cases by atropia sulphate,  $\frac{1}{100}$  grain, and in others by morphia,  $\frac{1}{8}$  grain The cases which demand local anæsthesia and in which general anæsthesia is contraindicated, I have not seen as yet An experienced anæsthetist is absolutely necessary, and a very small amount of the anæsthetic is to be used

The extirpation of the greater part of the growing gland is made in all cases Usually, one lobe and the isthmus are quite sufficient, but when the hypertrophy is vascular and bilateral, I think the symptoms have been best relieved when

one lobe, the isthmus, and a part of the opposite lobe are removed. In some instances the superior or the inferior thyroid artery of the opposite lobe has been tied in addition to the unilateral thyroidectomy. This was done to produce atrophy in the remaining lobe.

The method employed has been practically that of Kocher.

CASE I—Female, 20, 1897, xii, 10, 1898, i, 10. *Previous History*, negative. *Present History*—Immediately after childbirth, two years ago, neck began to swell, three months ago, palpitation.

*Examination*—Anæmic. Exophthalmos. Graefe's symptom. Pulse, 134. Moebius and Stellwag's symptoms abnormally strong. Pulsation felt in vessels of neck. Both lateral lobes are enlarged. Right lateral and middle lobes give the bulk of the mass.

*Operation*, 1897, xii, 15. Gas, ether, morphia. Right lateral lobe and isthmus and middle lobe removed.

*Immediate Result*—Temperature below 100. Nervousness and heart action better. Pulse, 90. Healing without reaction. No acute thyroidism.

*Present Result*—Seven years after operation. Best of health. Exophthalmos and tachycardia have disappeared. Pulse, 75 to 80.

*Pathological Examination*—Colloid struma.

CASE II—Female, 18, 1897, v, 10, vii, 3. *Previous History*, negative. *Present History*—One year ago at menstruation nervousness and tremor followed within two months by enlargement of the right side of the neck. Exophthalmos and palpitation.

*Examination*—Cachectic. Right lateral hypertrophy of thyroid, pulsates strongly on pressure. Palpitation, 130 to 140. Graefe and Moebius symptoms. Exophthalmos.

*Operation*, 1897, v, 12. Gas and ether. Extirpation of the right lateral lobe and isthmus. Ligature of left superior thyroid.

*Immediate Result*—Reactionless course. Four days after operation, pulse, 90, less nervous, less tremor, no palpitation.

*Present Result*—Seven years and five months after operation, continued improvement. Exophthalmos gone.

*Pathological Examination*—Right lateral lobe and isthmus show colloid struma

CASE III—Female, 17, 1898, v, 30, vii, 1 *Previous History*, negative *Present History*—Eight months ago neck began to enlarge Prominence of the eyes, palpitation and nervousness have increased steadily in spite of medicinal treatment

*Examination*—Anæmic Headaches, unrest Tremor of the hand Pulse varies between 110 and 160 Graefe's and Moebius's symptoms are present Exophthalmos well marked Left and right lateral lobes are enlarged, the right especially The swelling is soft and pulsates strongly

*Operation*, vi, 5 Gas and ether, morphia Removal of the right lobe and part of the left lobe

*Immediate Result*—Reactionless healing Two days after operation, temperature was 100°, 101° F, pulse, 100 to 120 Palpitation and nervousness are less Sleeps well

*Present Result*—Six years and seven months after operation Pulse, 70 to 80 Exophthalmos scarcely observable Does her work without difficulty

*Pathological Examination*—Parenchymatous goitre

CASE IV—Female, 26, 1899, iii, 12, iv, 20 *Previous History*, negative *Present History*—About five years ago noticed an enlargement of the neck, with exophthalmos, palpitation, and nervousness Four years ago, while in the country for three months, all nervousness disappeared, and she suffered alone from palpitation, with pulse frequency of 90 to 110 This continued for one year, when all symptoms returned Medicinal treatment has failed to give relief

*Examination*—Exophthalmos Graefe's and Stellwag's symptoms Slight difficulty in swallowing Pulse, 120 to 110 Heart sounds are good Slight tremor of the hands Excessive nervousness The left lateral lobe is greatly enlarged The right is not palpable

*Operation*, iii, 14, 1899 Gas and ether Removal of the left lobe The right not touched

*Immediate Result*—Reactionless course Pulse fell to 90 on second day Less nervous and anxious

*Present Result*—Five years and nine months from the operation Exophthalmos gone Nervousness and tremor have disappeared In good health and strength

*Pathological Examination*—Parenchymatous goitre

CASE V—Female, 39, 1901, II, 15, III, 5 *Previous History*, negative *Present History*—Seventeen years ago a small swelling appeared upon the left side of the neck. It remained so until eight years ago. It has steadily grown during the last three years. Nervousness, palpitation at times. Difficulty in swallowing.

*Examination*—On the left side the thyroid is enlarged. Slight exophthalmos. Some muscular tremor in hands. Palpitation upon slight exertion, heart jumping from 80 or 90 to 160 per minute.

*Operation*—Removal of the left lobe, isthmus, and middle lobe.

*Immediate Result*—Temperature fell from 101° F on day after to 99° F on the third day after operation. Pulse remains at 90, nervousness and tremor disappearing.

*Present Result*—Three years and ten months after operation. No exophthalmos, no restlessness, no palpitation on exertion. Best of health.

*Pathological Examination*—Left lateral lobe presents a firm tissue with several cysts. Alveoli are slightly distended with colloid material. The stroma is infiltrated with a thin albuminous substance, probably colloidal. There is an increase of fibrous tissue in the stroma.

CASE VI—Male, 31, 1901, IV, 25, V, 23 *Previous History*, negative *Present History*—One year ago neck enlarged. Eyes began to be prominent eleven months ago. Became nervous, with palpitation of heart on slight exertion. Difficulty in swallowing.

*Examination*—Marked exophthalmos. Tachycardia. Pulse, 120, respiration, 28, temperature, 99° F. Tremor of hands. Great nervousness. Compression of the trachea and œsophagus by the growth. Bilateral thyroidal enlargement, with substernal prolongation.

*Operation*, IV, 28. Gas and ether. Removal of both lobes was necessitated because of the substernal character of the growth and the collapse of the patient during the operation.

*Immediate Result*—Great restlessness. Excessive irritability. Temperature rose to 106° and 104.6° F following in the twenty-four hours to 99° and 100° F. Pulse, 172, 160, 140,



108 Respirations, 42, 28, 32 This condition continued for three days, when it gradually abated "Acute thyroidism"

*Present Result*—Three years and eight months from operation Tachycardia and restlessness gone Pulse has not been felt above 90, even during his work as a peddler Exophthalmos still noticeable Lids close easily and there is no stare

*Pathological Examination*—Enlargement of the lobes is uniform Medium-sized alveoli distended with colloid material, stroma is normal Right lobe 9 centimetres, 4 centimetres, 3 centimetres Left lobe  $8\frac{1}{4}$  centimetres, 4 centimetres, 3 centimetres Isthmus  $4\frac{1}{2}$  centimetres, 5 centimetres,  $2\frac{1}{2}$  centimetres

CASE VII—Female, 34, 1901, iv, 19, v, 3 *Previous History*, negative *Present History*—Began five years ago upon the right side of neck One year ago the eyes began to bulge Five months ago, tachycardia, pulse-rate greatly increased, has become very nervous Temperature,  $100^{\circ}$  F, pulse, 124

*Examination*—Marked exophthalmos, tachycardia, nervousness Right thyroid lobe is enlarged, heart, lungs, and kidneys are normal

*Operation*, iv, 20 Gas and ether, morphia Removal of the right lateral lobe

*Immediate Result*—Temperature ran between  $99^{\circ}$  and  $103^{\circ}$  F for three days Pulse from 155 to 80 During this time she was very restless and frightened These symptoms gradually abated The restlessness disappeared entirely as the temperature and pulse returned to the normal

*Present Result*—Three years and eight months after operation Nervousness and tachycardia gone Exophthalmos scarcely noticeable Pulse-rate normal Works daily without fatigue

*Pathological Examination*—Right lobe and isthmus are greatly enlarged, due to hypertrophy of the gland tissue, with increase in the colloid material "Adenomatous goitre"

CASE VIII—Male, 39, 1901, iv, 23, v, 11—*Previous History*, negative *Present History*—One year ago right side of neck enlarged, at present it is markedly enlarged Four months ago the eyes became prominent Nervousness has recently occurred Palpitation on slight exertion

*Examination*—Moderate exophthalmos Tachycardia

Pulse, 130, temperature, 99° F, respiration, 30 Excessive nervousness An enlarged right lobe of the thyroid

*Operation*, iv, 25 Gas and ether Removal of the right lobe and of the isthmus

*Immediate Result*—Temperature, 103° F, pulse, 132, respiration, 28 Nervousness Restlessness and tremor of hands These symptoms continued for three days, when the temperature and pulse returned to the normal The tachycardia and restlessness now disappeared

*Present Result*—Three years and eight months from the operation Tachycardia Nervousness and exophthalmos have entirely disappeared Works daily as a tailor

*Pathological Examination*—Adenomatous enlargement of the isthmus and right lobe of the thyroid gland

CASE IX—Female, 23, 1902, iii, 11, iii, 13 *Previous History*, negative *Present History*—Began four years ago Nervous, palpitation and general tremor began two years ago Dysphagia Temperature, 100° F, pulse, 134, irregular, respiration, 28 Otherwise normal

*Examination*—Marked exophthalmos General tremor Tachycardia, 116 to 124 Nervous Lungs and kidneys normal Bilateral thyroid enlargement, soft and vascular variety

*Operation*—Gas and ether During extirpation of the left lobe, the patient suddenly became cyanotic Respiration and pulse stopped at the same time No efforts at resuscitation availed Two and one-half ounces of ether had been administered This condition happened suddenly and unexpectedly There was no thymic hypertrophy found at this time

*Immediate Result*, death

*Pathological Examination*—No autopsy was permitted Simple vascular adenomatous enlargement of the left thyroid lobe

CASE X—Female, 30, 1902, iii, 25, iv, 23 *Previous History*, negative *Present History*—Five years ago nervous exhaustion with some exophthalmos and palpitation as symptoms Four years ago exophthalmos began to diminish Four years ago swelling in the neck was first noticed An improvement took place three years ago, and continued until one year ago, when all the symptoms returned with greater intensity

*Examination*—A diffuse bilateral thyroid enlargement

Marked exophthalmos Tachycardia Pulse, 120 to 130 Nervous Tremor of hands Graefe's and Stellwag's symptoms Lungs and kidneys normal

*Operation*, iv, 2 Gas, ether, and morphia Removal of both lobes, leaving an enlarged middle and a small part of one lateral lobe so as to preserve the superior thyroid artery and vein for its nutrition

*Immediate Result*—Restlessness and tremor began to diminish on the second day On the same day, pulse, 90, temperature, 100° F On fourth day, pulse, 80, temperature, 99° F

*Present Result*—Two years and nine months after operation Exophthalmos almost gone Tachycardia and nervousness disappeared Walks long distances without heart palpitation Tremor gone Health perfect

*Pathological Examination*—Bilateral adenomatous thyroid enlargement, very vascular

CASE XI—Female, 27, 1902, viii, 7, ix, 7 *Previous History*, negative *Present History*—Five years ago Palpitation, nervousness and tremor began Four years ago, exophthalmos Neck began to swell four years ago These symptoms have increased steadily, with frequent intermissions

*Examination*—Bilateral enlargement of the thyroid gland, soft to pressure Pupils dilated Marked exophthalmos Nervousness Heart overacting and sounds heard all over the chest Pulse, 104 to 120 Temperature, 99° F Lungs and kidneys normal Graefe's and Moebius's symptoms present

*Operation*, x, 6 Gas and ether, preceded by atropia sulphate,  $\frac{1}{100}$ , changed to chloroform One and three-fourths lobes removed The upper quarter of one lobe was preserved with its circulation intact

*Immediate Result*—For seven days, temperature remained between 99 and 102° F, pulse between 120 and 80, respirations between 20 and 24 The nervousness and the tachycardia gradually diminished The tremor less rapidly The exophthalmos not at all

*Present Result*—Two years and two months after operation is in the best of health Slight exophthalmos, but all else has disappeared It is noticeable in the history that seven months after operation this patient seemed to present some signs of cachexia thyreopriva in that she became listless, even stupid at

times, with short and brittle hair and a dry and scaly skin. She looked 'very old'. These symptoms disappeared within the following six months.

*Pathological Examination*—On section, the lobes show a uniform structure. No cysts, no abnormal amount of colloid material. It shows a typical structure of a parenchymatous goitre. There is newly-formed gland tissue in the form of small alveoli. The follicles contain but little colloid material. The stroma is moderate in amount and fibrous in structure. In many places it is infiltrated with small round cells.

CASE XII—Male, 45, 1904, x, 11, x1, 4. *Previous History*, negative. *Present History*—One year ago lost health and became very nervous, with headaches and pain in the stomach. Was treated for gastric disturbance. Six months ago slight exophthalmos and tachycardia began. The left side of neck began to enlarge.

*Examination*—Exophthalmos, tachycardia, nervousness. Slight tremor in hands. Hyperidrosis. Left lateral thyroid enlargement.

*Operation*, x, 12. Gas and ether, morphia. Left lobe and part of the right removed.

*Immediate Result*—Temperature and pulse were practically normal after operation. Nervousness and palpitation diminished. Complains of severe pain in the stomach as formerly. Exophthalmos less in the right than in the left eye. No stare.

*Present Result*—Three months after operation. Good health, has gained fifteen pounds. Nervousness and exophthalmos have diminished. Nervousness almost entirely. The exophthalmos more so in the right than in the left, but some is still present. Pulse, 80. No palpitation on exertion.

*Pathological Examination*—A pure parenchymatous goitre.

CASE XIII—Male, 17, 1904, x1, 1, 16. *Previous History*, always well. *Present History*—Three years ago, palpitation of heart began, nervousness and trembling of hands. Later the eyes became prominent. Pulse, 70 to 120. Neck has enlarged greatly within the last year.

*Examination*—Bilateral thyroid enlargement, soft, vascular, and uniform. Exophthalmos. Graefe's and Stellwag's symptoms present. Tachycardia, pulse-rate varies between 70 to 120, slight muscular tremor in hands. Nervousness and hyperidrosis.

*Operation*, xi, 2 Gas and ether, morphia Removal of the right lobe, isthmus, and middle lobes Ligature of the superior thyroid artery and vein of the left side

*Immediate Result*—Temperature ranged for five days between 104° and 99° F, pulse, 130 to 90 Slight bronchopneumonia Nervousness Tremor was marked during this time This condition was looked upon as a slight degree of acute thyroidism, although there was present evidences of a slight bronchopneumonia After five days these symptoms all abated rapidly, and the patient left the hospital on the fourteenth day after operation completely healed

*Present Result*—Two months after operation Best of health, with freedom from feeling of unrest, palpitation on exertion Is working daily at his trade The exophthalmos has greatly diminished, though it is still present The “stare” is gone, and the ability to close the lids in all positions of the eye is perfect

*Pathological Examination*—Right lobe equals 11 centimetres, 5 centimetres, 4 centimetres, middle lobe equals 6 centimetres, 4 centimetres, 2 centimetres There is a moderate enlargement of the alveoli, which are filled with colloid material Some alveoli contain a moderate amount of blood pigment The stroma is very vascular In parts newly formed, gland tissue is seen in the form of small alveoli with but little colloid matter, and here the stroma is infiltrated with small round cells Colloid parenchymatous goitre

CASE XIV—Female, 26, single, 1905, iii, 23, 1905, iv, 6 *Previous History*, negative *Present History*—Exophthalmos and tachycardia Became very hysterical, condition gradually increased with remissions Swelling in neck began six years ago

*Examination*—Diffuse bilateral thyroid enlargement Circumference of neck, 33 centimetres Exophthalmos Tachycardia, 90 to 120 Graefe's and Stellwag's symptoms Lungs and kidneys normal

*Operation*—Gas, ether, and morphia Hæmithyroidectomy with ligature of superior thyroid artery and vein of remaining lobe

*Immediate Result*—No temperature Diminution of restlessness

*Present Result*—Three months after operation exophthalmos

rapidly diminishing Tachycardia and nervousness gone Health perfect

*Pathological Examination*—Vascular adenomatous thyroid

CASE XV—Female, 25, single, 1905, v, 8, 1905, v, 20 *Previous History*, negative *Present History*—Six years ago prominence of eyes and nervousness with tumor of hands began Has continued Two years ago several patches of scleroderma and alopecia areata appeared Has been treated in vain by medication

*Examination*—Diffuse bilateral thyroid enlargement Circumference of neck, 34 37 centimetres Tachycardia, 90 to 120 Graefe's and Stellwag's symptoms Exophthalmos Very nervous Kidneys and lungs normal

*Operation*—Hæmithyroidectomy with ligature of the superior thyroid artery and vein of opposite lobe

*Immediate Result*—No temperature Pulse, 90 to 110 Restlessness Tremor diminished

*Present Result*—One month after operation Tachycardia, nervousness gone Exophthalmos much diminished Health perfect

*Pathological Examination*—Vascular and colloidal goitre

Fourteen of these patients, seen at times varying between one month and seven and a half years following their operation, are in good health, and able to work at their avocations without discomfort They have all lost their anxiety and nervousness

Their muscular tremor and in all but three cases their exophthalmos have disappeared In these cases, however, though the eyes appear prominent, they are easily covered by the lids, and are free from the "stare" and feeling of distention which the patients formerly experienced The reason for these results I believe to be due to the removal of sufficient diseased gland tissue, and where this cannot be done, the production of atrophy in that which is left In no one of these cases has there been a return of the symptoms relieved by the operation This is a significant fact, which substantiates Schulz's and Mikulicz's five cases with recurrence of

symptoms and relief by a second operation The recoveries and cures are 93·4 per cent The mortality is 6·6 per cent

These cases comprise all those which I have been able to trace after operation, and these cases date back to 1897 Between 1887 and 1897 I operated upon six other cases, but of these I can obtain no data after leaving the hospital Of these six cases there was one death from an acute thyroidism in 1893 The remaining recovered and left the hospitals No trace can be obtained of these, and, though it is to be presumed that they are at least improved, still they cannot be here included If we consider all these cases (21) operated upon between 1887 and 1905, we have 19 recoveries and 2 deaths, 90·5 per cent and 9·5 per cent, respectively

One of these deaths occurred during anæsthesia, and must be considered as unavoidable It represents purely the necessary risk to be considered in these cases

The death from acute thyroidism in 1893 I think can be looked upon somewhat differently The symptoms of this condition bear a very direct relation to the manner and extent of operation Where operations are prolonged and the handling of the tissues is unavoidably severe, the reaction is usually seen in this wise In the thirteen cases above operated upon since 1896, when the technique of the operation was better understood, only one case of acute thyroidism was seen

The operation of partial thyroidectomy compares favorably with that of sympathectomy, if we rely upon the statistics collected by Balacescu (*Archiv für klinische Chirurgie*, Band lxxvii) These are

I Division of the cervical sympathetic (Jaboulay) Eight cases, six bilateral, two unilateral Results, 25 per cent cured, 62+ per cent improved, 12+ per cent died

II Partial and extensive resection of the cervical sympathetic Twenty-seven cases Results, 33·3 per cent cured, 40·7 per cent improved, 7·4 per cent failed, 18·6 per cent died

III Total bilateral resection of the cervical sympathetic Eighteen cases Results, 55·5 per cent cured, 27·77 per cent improved, 11·3 per cent recurred, 5·5 per cent died

I believe the case of sudden death under the chloroform should be included and not excluded from these cases Balacescu excludes the case, and consequently has no mortality

The best statistics here shown are the total bilateral resections, with 55.5 per cent cured, 27.7 per cent improved, 11.3 per cent recuried, and 5.5 per cent died

Balacescu compares these cases with the results obtained in 434 cases collected by Tricomi, Starr, and Largo These results are 30.6 per cent cured, 44.6 per cent improved, 10.8 per cent failures, 13.7 per cent died Better statistics than these have been obtained by the operation of thyroidectomy They are

I Rehn, of 119 cases collected from literature Results, 54.8 per cent cured, 27.9 per cent improved, 5.9 per cent failed, 11.4 per cent died Of 177 cases performed by 37 operators, results were practically the same as the above (*Mittheilungen aus dem Grenzgebiete*, vii, 1900 )

II Schulz (*Beitrag zur klin Chn* , Band xxx), 1901 Twenty cases, with 90 per cent cured, 5 per cent failed, 5 per cent died

III Kocher Fifty-nine cases, in which thyroidectomy was performed forty times with or without ligature of thyroid arteries or resection of other lobe Results, 76 per cent cured, 14 per cent improved, 3.3 per cent benefited, 6.7 per cent died (*Mittheilungen aus dem Grenzgebiete*, ix, 1902 )

The best statistics here are those of Schultz's, with 90 per cent cured, 5 per cent failed, 5 per cent died When we compare these statistics of Schulz's with those of Balacescu collected from the cases of Jonnesco, Faure, and Poignez, we find that the cures are in favor of partial thyroidectomy, and that the mortality is about the same

There are three series of cases which will alter these statistics somewhat, they are those of Curtis, of the Mayos, and my own

Curtis reports seven cases of bilateral total resection of the cervical sympathetic with the following results, 42.8 per cent cured, 14.2 per cent improved, 42.8 per cent died These



deaths were due to acute thyroidism and one under the anæsthetic (ANNALS OF SURGERY, 1904, vol xxxviii )

If these statistics are added to Balacescu, we have 52 per cent cured, 24 per cent improved, 8 per cent unimproved, and 16 per cent died

Curtis (l c ) again reports eleven cases with 54 5 per cent cured, 9 per cent improved, 9 per cent lost sight of, 27 2 per cent died

The Mayos report thirty-four cases, with the following results, 41 2 per cent cured, 20 6 per cent improved, 20 6 per cent partially improved, and 17 6 per cent died (*Journal of American Medical Association*, vol xlii )

If Curtis's, Mayos's, and my own are added to Schulz's and Kocher's statistics, the average results are, 71 per cent cured, 9 6 per cent improved, 6 4 per cent unimproved, failures, lost sight of, or partly benefited, and 12 6 per cent died

These statistics show that, after all, the results are about equal, but with the advantage in favor of thyroidectomy both as regards the mortality and the cures

My object in this statistical computation is not to advocate one operation against the other, but to show that at present the results still favor the thyroidectomy

# THE SURGICAL TREATMENT OF TUBERCULAR CERVICAL LYMPH-NODES.

A STUDY OF ONE HUNDRED CASES SUBMITTED TO OPERATION

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THE treatment of "scrofulous neck swellings" is as old as the history of medicine. Innumerable methods have been devised, and many of them are still in use. Recovery follows in a large percentage of the cases, and the treatment under which each recovery comes is sure to have its advocates. During the last two or three decades, however, as surgical technique has improved, the surgical removal of the enlarged nodes has steadily increased in favor, and is now recommended, as the method of choice, by a very large number of our prominent authorities. There is, however, a wide-spread feeling of uncertainty about the late results of operation, and there are many differences of opinion as to just what patients should be operated upon and just what kinds of operations should be done.

## STUDY OF PUBLISHED STATISTICS CONCERNING THE COURSE OF THE DISEASE AND THE RESULTS OF TREATMENT

The literature of this subject is very extensive and contains a vast fund of information. It is based largely on reports from European clinics which have been made after the examination of patients who had previously been operated upon. To review it in full would carry this paper beyond the bounds of periodical publication. There are, however, certain deductions which particularly impress one who studies it, among which I will mention three

1 The disease is a serious one, and often leads to tuberculosis of the lungs or other parts of the body

2 The records from thorough removal of the nodes are better than those from their partial removal or from palliative measures

3 The prognosis is better in children than in adults

1 The seriousness of the disease and its liability to lead to infection of the internal organs is shown in the few available records of cases treated non-surgically, and in most of the records of cases which have been treated surgically

Demmè, in reviewing the first twenty years' work of the Jenner Children's Hospital in Berne gives the following results from 692 patients with lymph-node tuberculosis who were treated by constitutional measures, not by surgery

Developed tuberculosis of lungs,	145	= 21 per cent
“ “ intestine,	24	} 57 = 82 per cent
“ “ pia mater,	25	
“ “ kidneys,	6	
“ “ epididymis,	2	
Total,		292 per cent

These records make no mention of the bone infection, nor do they tell of the lymph-nodes themselves, and, as the observation period in many instances had been short, they do not even tell the ultimate extent of the infection of the internal organs. They do, however, indicate that such infection was very frequent

Van Noorden learned the histories of 149 patients from the Tübingen Clinic 3 to 16 years after operation, and found that 28 had died of tuberculosis and that 14 had phthisis when examined, *i e*, 28 per cent in all

Blos's Heidelberg statistics gave, among 160 cases whose histories were known 3 to 12 years after operation, 26 per cent of lung tuberculosis and 14 per cent of tuberculosis in other organs, *i e*, 40 per cent in all, and he quotes from the records of the universities of Vienna (49 cases), Bonn (37 cases), Breslau (92 cases), Strasburg (104 cases), and Erlangen the percentage of cases who died from tuberculosis,

almost exclusively pulmonary, as respectively 10 per cent, 11 per cent, 18 per cent, 22 per cent, 26 per cent

Finkelstein, who did not follow his cases after they left the hospital, recorded that 51 in 456, *i e*, 11.2 per cent, had lung tuberculosis

Fischer has tabulated from literature the reports of 1273 cases (including many of the above), 1 to 16 years after operation, as follows Cured, 57.65 per cent, local recurrences, 21.84 per cent, died, almost entirely from tuberculosis, 13.51 per cent

These reports certainly indicate the serious nature of the disease, even granting that in some of the cases the cervical tuberculosis may have been secondary to foci in other parts of the body

2 It is very significant that the records of long series of cases followed through many years have come almost exclusively from the clinics where operative treatment has been used, and the tendency has been continually towards thorough operation in these clinics. The observers from the seaside hospitals of Loano, Berk zur Meer, and Margate have given records of the results of the treatment for a season or for short periods, but no record of long periods of observation of the patients after leaving the hospitals has reached the writer's notice. Cazin from Berk zur Meer favors operation, and Sutcliffe and Harnett from Margate have carefully given details of operative technique and described the class of patients to whom they should be applied

In almost all the clinic reports reference is made to the use of constitutional treatment, injection of various substances, and different kinds of local treatment, but these have been tried to test their value, and the main reliance is placed on operations. The most definite statistics concerning the different kinds of operation which I find are those of Wohlge-muth. He divides his cases into those treated without operation, those treated by incision and curetting, and those treated by extirpation, as follows

	Cured		Improved		Unimproved		Total
	No	Per cent	No	Per cent	No	Per cent	
No operation	11	24	17	37	18	39	46
Incision and curetting	23	63	10	27 7	3	8 3	36
Extirpation	32	70 5	10	22 8	3	6 4	45
Total	66	51 5	37	29 5	24	19	127

Other observers do not divide their cases so definitely, the operations in each series having usually been done by several men whose methods of operation have varied. There are, however, in the reports many statements which indicate the preference of the reporter, e g, Bloss states that cases treated by excision did much better than those treated by incision, and that patients treated in the latter way almost always came to the radical operation. Among his 76 cured cases there was not a single one whose only operation had been an incision, although there had been 108 "incisions" among the 429 operations in his entire series of cases.

Sutcliffe advises a thorough removal of the glands in all cases which are operated upon.

Grunfeld, who records treatment of 32 cases locally and constitutionally, 25 cases by curettement, and 125 cases by total extirpation, advises the latter as the most certain method, leading to improvement even in those patients who are not cured.

D'Arcy Power advocates thorough and early removal before caseation has taken place.

Karewski, who has operated on over 250 cases, including those reported by Wohlgemuth, and had made a careful trial of various methods of treatment, strongly advocates thorough removal by operation.

Jordan, with an experience of over 400 cases, some of them tabulated by Bloss, treated by operations of various kinds, strongly advocates thorough removal of the diseased nodes, and particularly emphasizes the futility of partial excision in those patients who have extensively adherent nodes, stating

that the resulting sinuses may be open for the rest of the patient's life

Mitchell, reporting from Halsted's clinic (170 cases), advocates thorough operation

Almost all operators of large experience advocate thorough operation, although there are differences in their conceptions of what constitutes thoroughness

3 That the prognosis is better in children than in adults is very generally acknowledged. The statistics from Demmè and Wohlgemuth's non-operative cases in children are not favorable, but that may be believed to be due to the method of treatment. The results from Wohlgemuth's operated cases under ten years of age, from Poore's cases under fourteen years of age, and those of the writer's cases which are under fifteen years of age, are particularly favorable. Blos's cases did not give very favorable statistics, and only nine in the series were in the first decade of life. He and Schuller call particular attention to the much better prognosis in children than in adults

Karewski particularly emphasizes the favorable prognosis in children as compared to adults, and refers to the 128 cases under ten years of age from his clinic, which Wohlgemuth has tabulated, followed one to six years with only three deaths from tuberculosis

#### DESCRIPTION OF THE OBSERVATIONS UPON WHICH THIS REPORT IS BASED

The patients, 100 in number, have been operated upon by the writer in St. Mary's Free Hospital for Children, the General Memorial Hospital, and in private practice between December, 1893, and February, 1904. The operations have consisted of thorough removal of the nodes with the minimum disturbance of the surrounding tissues, by the method described later, differing in this respect from most of the reported observations which include patients treated by incision, by curetting, and by excision. The ages of the patients were

57 in the first decade of life, 28 in the second decade, 9 in the third, 5 in the fourth, and 1 in the fifth

Very careful efforts have been made to follow their later histories, a nurse having visited or written to hospital cases at intervals of six months or a year, and induced many of them to report at the hospital, where they have been personally inspected by the writer and their conditions recorded. Most of the other patients have been under the continued observation of the attending physician or of the writer. The examinations were made by the writer in 62 cases, by another physician in 14 cases, by a nurse in 6 cases, the report was made by the patient or a relative in 6 cases, 12 patients were not seen after leaving the hospital. Thirty-six of the patients were the subject of a preliminary report in this Journal in 1899. Microscopical examination of the removed nodes was made in all but eighteen of the cases, and in them the gross appearance was so characteristic of tuberculosis that the diagnosis was beyond question.

Animal inoculations were made in a few instances to study the virulence of the bacilli.

#### DETAILS OF THE REPORT

We will consider in slight detail the Previous Clinical Histories, the Etiology and the Diagnosis, and in more detail the Anatomical Arrangement of the Nodes, the Technique of the Operation, and the Results.

*Previous Clinical History*—The disease usually commenced insidiously, and it was impossible to learn when the nodes began to enlarge. In 38 of the obtainable histories the duration was given as less than a year, in 58 it was from one to ten years. The rapid enlargement and softening of a single node was frequently the factor which led the patient to seek surgical relief, often this node alone had been noticed, and hence the history of a rapid and short growth was given, when in reality there were many others present, and there must have been a slowly progressing growth for weeks or months. In 30

instances there were discharging sinuses when the patients first came under our observation. In 19 instances there had been previous incisions, or operations. In 47 instances the disease had become "very extensive," approaching the condition shown in Figs 6, 7, and 12. In 21 instances both sides of the neck had become involved. There was frequently a history of a preceding pharyngitis, a large proportion of the patients applied for treatment in the late winter or in the spring, following the prevailing winter throat inflammations.

*Etiology*—The majority of the patients lived in unsanitary surroundings (New York tenement houses), but at least 26 per cent developed the disease while in very comfortable environment. Heredity seemed much less important than environment as an etiological factor.

The throat was apparently the most common portal of infection. In 86 instances (86 per cent) the group of nodes which seemed to have been first enlarged was the one which directly receives the throat infection (Fig 3). Many observations indicate the occasional presence of tubercle bacilli and tubercle tissue in enlarged tonsils and adenoids, *e g*, Lewin examined pharyngeal adenoids from 200 patients in Breslau and found tubercular infection in 10 (5 per cent), and in grouping 905 similar observations he found records of 45 infections, *i e*, 5 per cent. Dieulafoy inoculated guinea-pigs from the faucial tonsils of 61 children apparently non-tubercular, in 8 instances 16.4 per cent tuberculosis developed, and from 35 similar inoculations from the pharyngeal adenoids there were 7 tubercular infections, 20 per cent.

Coakley and others have also found tuberculosis in the faucial tonsils.

Wright, Cornet, and others have reported the finding of tubercle bacilli on healthy nasal mucous membrane. There can be no doubt that tubercle bacilli are occasionally present on or in the mucous membrane of the oropharynx, nasopharynx, and nose of persons in ordinary health.

There is also abundant evidence that the bacilli can go



through the mucous membrane and infect the lymphatics without leaving visible evidence of their transit, *e g*, Cornet brushed tubercle bacilli on the nasal mucous membrane of healthy animals, and later found enlarged tubercular cervical lymph-nodes with caseous spots, the mucous membrane showing no lesions

Wright has shown a microscopical section which demonstrates a similar process in the larynx

Goodale has shown that carmine particles pass through the mucous membrane of the tonsils, and Henderson has shown that similar absorption takes place when various powdered substances are blown on the surface of pharyngeal as well as faucial tonsils Wright's description of this process seems to be very accurate "The mucous membranes absorb, the lymphoid material harbors, and the lymph channels carry the tubercle bacilli"

In three instances in this series, or in the cases which the writer has since operated upon, the disease appeared in two children of the same family In one instance a phthisical relative had spent the winter in the house a few months before In another, one of the children had been an intimate playmate of a tubercular child In all these six instances the first nodes involved were the upper ones of the deep cervical chain, and the probability of infection by the lodgement of bacilli in the pharynx is of course very great

In eleven instances the submaxillary group of nodes was the first enlarged, indicating infection from the teeth or anterior part of the mouth or face In two instances the parotid nodes were the first to show infection In one case of neck lupus the location of the primary infection could not be determined

*Diagnosis* —The diagnosis is not always easy It is frequently difficult to distinguish between tubercular nodes and simple hyperplastic nodes If discharging sinuses are present, or discrete, softened nodes, or masses of nodes such as are shown in Figs 4 and 5, or nodes smaller than these which have been steadily growing for several months, they will

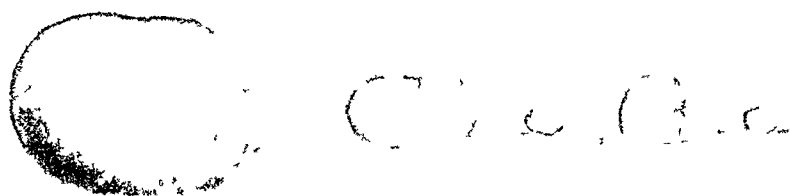


FIG 1 —Hyperplastic cervical lymph nodes which had reached an unusual size without pus formation. Diameters of largest node,  $1\frac{1}{8}$ ,  $1\frac{1}{8}$  and  $1\frac{1}{8}$  inches

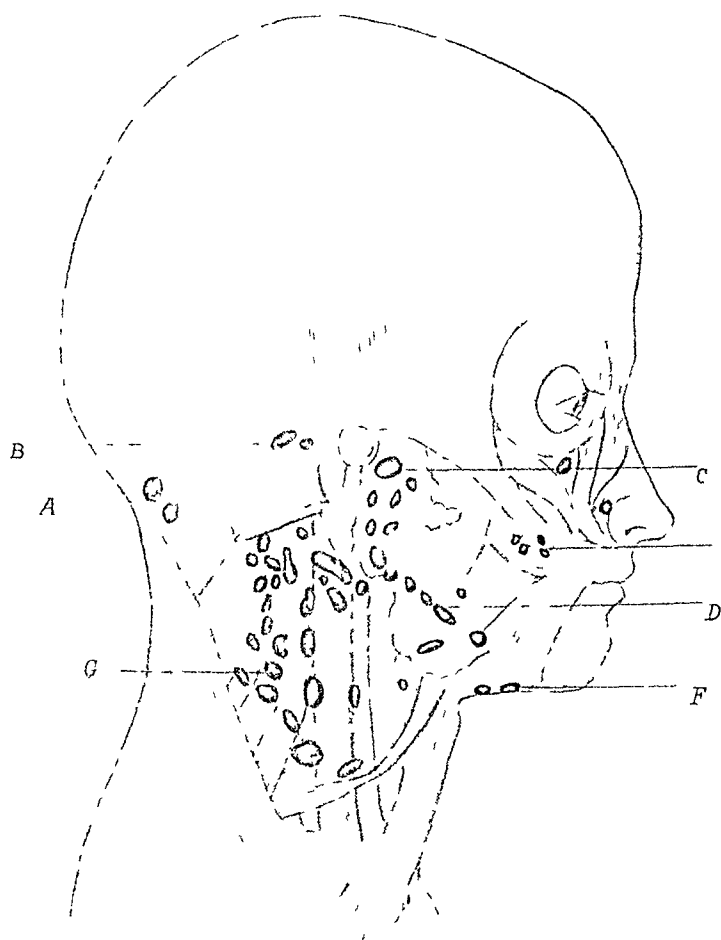


FIG 2—(From *The Lymphatics*, Delamere Poirier, and Cuneo ) General arrangement of the lymph nodes in the head and neck. *A* Occipital group, *B* mastoid group, *C* parotid group, *D* submaxillary group, *E* submental group, *F* submental group, *G* deep cervical chain

usually prove to be tubercular. There are, however, many instances where hyperplastic nodes become as large as the terminal phalanx of one's thumb, alternately enlarge and diminish in size, and after months or years disappear. Fig 1 gives the size and appearance of such nodes which had reached an unusual size, and which showed no evidence of tuberculosis on microscopical examination, nor did they recur.

In instances where the diagnosis is still doubtful after a suitable period of observation, the removal of one or more nodes for diagnosis is to be recommended, the scar need hardly be seen, and the method is surely more satisfactory than the injection of tuberculin.

Deep abscesses from acutely infected nodes, or actinomycosis, do not often give difficulties in diagnosis. Syphilis is to be borne in mind, and in doubtful cases constitutional treatment given. In lymphosarcomata the nodes usually reach a large size without becoming fluid, and they are very widely disseminated.

Branchial cysts or sinuses are usually single, and often have a distinctive location.

THE ANATOMICAL ARRANGEMENT OF THE ENLARGED NODES, which sometimes seem hopelessly complex, is really definite and reasonably simple. Fig 2 (Poirier and Cuneo) indicates the general arrangement of the node groups in the head and neck. The deep cervical chain (*G*) is the general collector of the lymphatics of this region. There are five groups of nodes which receive the superficial lymphatics before they reach this central chain, the occipital, the mastoid, the parotid, the submaxillary, and the submental (see *a, b, c, d, f*). The latter two may also receive infection from the teeth, gums, and anterior part of the mouth.

Only in exceptional cases are any of these five groups primarily involved in tubercular inflammation. Fig 5 shows the appearance of such involvement.

The main interest centres in the deep cervical chain, particularly in the upper nodes of this chain, which receive, either directly or through the post-pharyngeal nodes, the infections

from the pharynx, the nasal, and much of the oral mucous membranes. These upper nodes, as above stated, were apparently the first involved in 86 per cent of these cases. The appearance of an early infection is indicated in Fig 3. The node, *A*, is most easily felt, but the nodes, *B B*, which lie behind it under the sternocleidomastoid muscle are regularly enlarged.

Fig 4 shows the appearance of patients with enlargement of this group. The infection spreads regularly downward along the internal jugular vein, also downward and backward towards the trapezius border and the base of the neck, as shown in Fig 3. When the infection is widely disseminated, the submaxillary and submental groups usually become secondarily involved. The involvement of the lungs has already been referred to. The existence of a single enlarged node in this central chain is evidence that others exist, and whenever one is removed, the region under the sternocleidomastoid muscle should be explored as a routine procedure.

THE DESCRIPTION OF THE OPERATION may be given under the following headings:

1 Incisions 2 Structures which are to be removed and structures which are to be avoided 3 Details as to time, method of wound treatment, etc

1 *Incisions*—The arrangement of incisions is very important. The fear of disfiguring scars leads many to postpone operation until the most favorable time has passed, or even until tuberculosis has invaded other organs. Unsightly scars can almost always be avoided by due attention to the anatomical arrangement of the enlarged nodes and by avoiding longitudinal incisions in prominent places. Longitudinal neck scars stretch and frequently thicken. Transverse scars which follow the curves of the neck-creases do not stretch, and after a little time are hardly to be seen, a fact to which Kocher called attention many years ago, and which is continually being verified.

One frequently sees on the same neck longitudinal scars which are broad, thick, and prominent, while the transverse

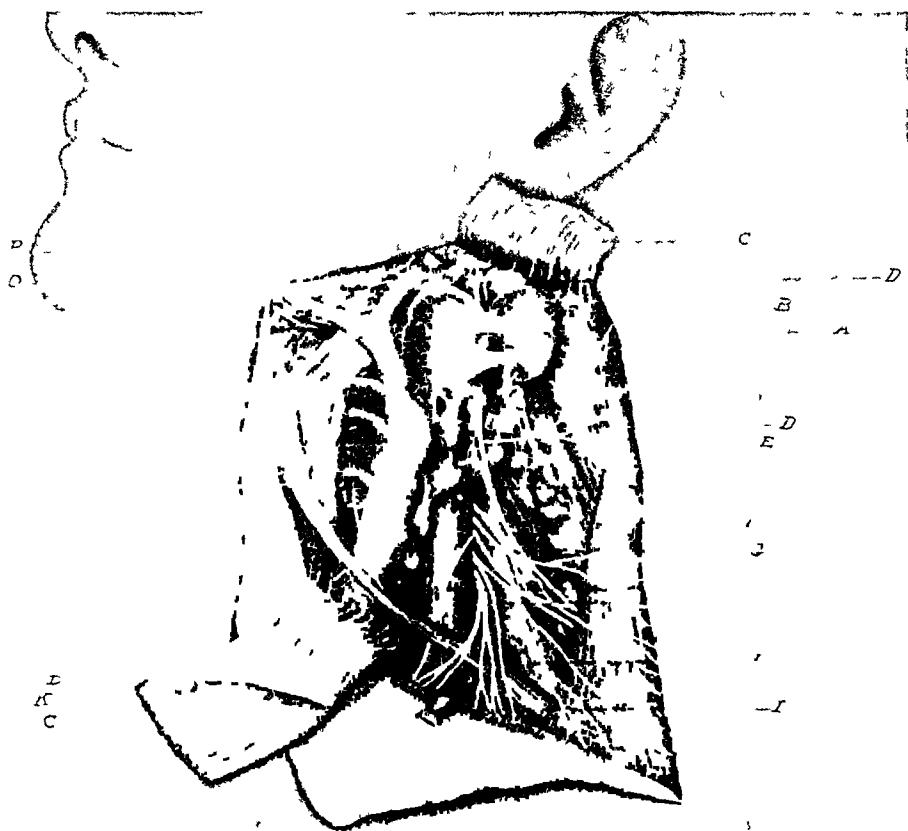


FIG 3—Early tubercular infection of the deep cervical chain. *A* Most prominent caseous node, *BB* caseous nodes under sternomastoid muscle, *CC* sternomastoid muscle, *DDDD* spinal accessory nerve, *E* trapezius muscle, *F* Levator anguli scapulae muscle, *GGG* branches of cervical plexus, *H* scalenus posticus muscle, *I* external jugular vein; *K* course of posterior branch of spinal accessory nerve cut from sternomastoid muscle, *L* omohyoid muscle, *M* internal jugular vein, *N* facial vein, *O* posterior facial vein (anterior division of temporomaxillary), *P* parotid gland



1

1



2

1



3

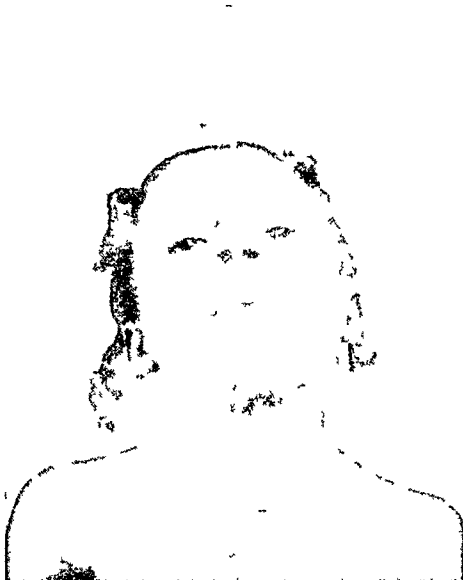


4

FIG 4—Photographs of patients with tubercular infection of the deep cervical chain of lymph nodes. Nos 1 and 2 show early infection, No 3, abscess formation, and No 4, inflammation of the lower as well as the upper part of the chain.



1



2



3



4

FIG 5—Photographs of patients with tubercular inflammation of, 1 submandibular, 2 submandibular, 3 and 4 parotid groups of lymph nodes





FIG 6 —A neglected case



FIG 7—Extensive tubercular inflammation of upper and lower cervical lymph-nodes



FIG 8—Incisions for removing moderately enlarged lymph nodes. *A* Gives access to the upper nodes of the deep cervical chain which are usually first enlarged, *B* gives access from behind if the nodes under the sternomastoid muscle are not removed through *A*.



FIG 9—Two transverse incisions for removing moderately enlarged nodes



FIG 10—Two incisions which give access to a large part of the neck and leave little scar above the collar line



FIG 11—Photograph of patient with incisions shown in Fig 10, taken sixteen days after operation



1



2

FIG 12—1 Photograph of patient fourteen days after operation, "elbow" incision, anterior part transverse posterior part along hair margin and down to shoulder, large flap turned forward 2 Same patient before operation showing extensive mass of nodes

scars which were made at the same time and treated in the same way are hardly to be distinguished from the natural neck-creases

Therefore the incision, *A* (Fig 8), is a very important one. Through it such a group as is shown in Fig 3 can be approached and often removed, and after healing the scar is hardly visible. Removal of the nodes through this incision is more difficult than through a longitudinal one, but the later result is so good that it may be recommended as the primary incision in nearly all cases of moderate severity. A counter-opening back of the hair-line, *B*, is used if the upper nodes cannot be satisfactorily removed through incision, *A*. For lower nodes, another transverse incision, *C* (Fig 9), may often be used, or this and the vertical may be joined (Fig 10). A good exposure of a large area with little noticeable scar may thus be obtained (Fig 11). The vertical incision is, however, to be used as little as practicable, as even here it shows the characteristic tendency to stretch and thicken. In thirty-two cases one or both of these incisions have been sufficient, and without doubt the number would have been greater if they had been used earlier.

The submaxillary group can be reached by carrying the transverse incision forward. The submental group can be reached either by carrying it still further forward or by a median vertical incision. Occasionally, in far advanced cases, the transverse incision, *A*, and the vertical incision, *B*, may be joined in a curve behind the ear, and the entire flap laid forward as described in a previous paper. Fig 12 indicates how little the scar shows after this very extensive incision. This incision has been used twenty-four times in this series. With increased experience, it seems necessary less frequently than formerly.

A very careful study has been made of the results of the incisions in these 100 cases, as well as in many cases which have been treated by other operators and others which have been permitted to suppurate without operation, and I can confidently state that operation on the plans here laid down is a



scar-saving procedure There is less disfigurement than comes from suppuration without operation, or from small incisions in separate nodes, or from those extensive operations which are made without reference to scars

The longitudinal incision near the anterior border of the sternomastoid muscle is probably more often used than any other, and surely should be considered It exposes the internal jugular vein well and gives easy access to the nodes along its course, and on that account is probably the safest form of incision It is, however, a disfiguring incision, a few months after operation the scar will usually be one-quarter of an inch wide or more, and it is in the most prominent part of the neck This incision does not give access to the submaxillary or submental groups, nor to the posterior cervical nodes, hence additional incisions are needed for them It should not be joined by the submaxillary incision when both are used, as the angular flap is apt to retract and leave a particularly noticeable scar

Dollinger has reported 100 cases in whom he has removed the nodes through a vertical posterior incision alone, but most surgeons prefer some kind of an anterior incision, excepting in a few patients with long, thin necks, and non-adherent nodes

2 *Structures which are to be Removed and Structures which are to be Avoided*—The removal of the nodes *en masse*, together with the surrounding tissue, as though they were cancerous, is to be avoided Important structures are injured by this procedure, although technically it appears to the operator The removal of all the tubercular nodes is to be desired, and only so much of the adjacent tissue as is distinctly infiltrated with tubercular inflammation

There are three structures which are particularly to be protected the internal jugular vein, the spinal accessory nerve, and the lower fibres of the facial nerve There are other structures which are to be heeded, but which are either less important or less likely to be injured, *e g*, the sternocleidomastoid muscle, the thoracic duct, the phrenic nerve, the

pneumogastric nerve, the hypoglossal nerve, the branches of the cervical plexus

*The internal jugular vein* is freely exposed in almost every operation and the nodes are sometimes densely adherent to it. Traction on the nodes sometimes flattens the vein so that its margin looks like the fibrous tissue about the node capsule, and in this condition it is incised or torn. More often, however, a branch of the main vein is first injured, and in the effort to control the hæmorrhage the vein itself is clamped and torn. The posterior facial in its course from the external jugular to the anterior facial is particularly exposed to injury. The veins from the pharyngeal plexus, too, are easily injured, and, as they empty directly into the internal jugular and have no valves, bleeding from them may be very free. When, therefore, severe venous bleeding occurs in the course of an operation, it is usually best to pack the bleeding spot with gauze and turn to another part of the wound. If the hæmorrhage has been from one of the small branches, it will usually have ceased, or be so slight as to be easily controlled when the pressure is removed. If it is from the posterior or common facial, a ligature can usually be applied without injuring the internal jugular. If it is from the internal jugular itself, a running suture of fine catgut may be taken through the vein wall about the injured spot, or a lateral ligature may be applied, or the vein may be ligated above and below. In this series of cases it has been ligated five times with no ill effect. Some operators ligate it much more frequently, it is generally believed to be a harmless procedure. At least three fatal cases have been reported, however (Lenser, Kummer, Rohrbach). In two of them the remaining internal jugular was narrow, in the other it is believed to have been compressed by the bandage. Although there is seldom any ill effect from ligating one vein, one will be careful about ligating it on remembering that the tubercular nodes frequently come on both sides, and that the ligation of the second vein may be serious. Baldwin, however, reports ligating both at one operation without ill effect.

*The Spinal Accessory Nerve*—This nerve is particularly exposed to injury Between the stylomastoid foramen and its entrance into the sternomastoid muscle (Fig 4), it usually lies between the enlarged nodes, so that if they were taken out *en masse* it must be divided In this locality it is often flattened out, closely resembling gland capsule, and very great care is necessary to avoid it in the very locality where the nodes are most often infected Between the sternomastoid muscle and the trapezius it is also in an exposed position, and closely resembles some of the branches of the cervical plexus Nodes are often matted closely together in this region, too, and they should be dissected away with the utmost care The division of this nerve is followed by an awkward drooping and weakness of the shoulder, with atrophy of the trapezius or sternocleidomastoid, or both, according to the place of division If the ends of the nerve fail to unite, as sometimes happens, the deformity is permanent Bailey cites a case of very serious disability from division of this nerve

*The Lower Fibres of the Facial Nerve* (Ramus anastomoticus collo-mandibularis Jaffé) An unsightly paralysis of the lower lip sometimes follows incisions in the neck below the border of the jaw It is usually temporary, but Fig 13, 1, shows an instance in which it is permanent, following an operation which was done in Italy more than ten years ago Fig 13, 2, shows an instance less marked in which it was caused by pressure of the growth, not by operation, since no operation had been done The muscle depressor labii inferioris (quadratus menti) is the chief factor in this paralysis, the nerve filament which supplies this muscle is marked *B* in Fig 14, a drawing from a dissection made by Mr Draper, of the College of Physicians and Surgeons The subject has been very carefully worked out by Jaffé, also by Frohse and Bockenheimer The former has made many dissections of this nerve twig, and has found that it sometimes accompanies the cervical filaments of the nerve three-quarters of an inch or even more below the angle of the jaw before turning upward and forward Both Frohse and Bockenheimer call attention



FIG 13—1 Partial paralysis of depressor labii inferioris from section of lower filament of facial nerve more than ten years ago 2 Partial paralysis of same muscle from pressure of enlarged nodes, no operation



FIG 14—Dissection showing lower filaments of the facial nerve especially the Ramus anastomaticus collomandibularis Jaffé which supplies the depressor labii inferioris. A Cervicofacial division of the facial nerve B ramus anastomaticus collomandibularis, C filament to platysma myoides D parotid gland, E deep cervical fascia F platysma myoides

not only to the variations in this nerve twig itself, but to variations in the nerve supply of the lip muscles. It seems to be well established, however, that the depressor anguli oris (triangularis menti) receives a filament from middle branch (ramus maximus) of the facial, and hence does not take part in the paralysis, also that the platysma, whose fibres blend with both the quadratus and triangularis menti, has an influence, but only a slight one. During the past year the writer has made a very careful study of the lip muscles in the cases which have come back for observation, and has only found one marked paralysis, that in a patient for whom multiple operations had been done extending over a period of years. There has been a temporary slight paralysis in many instances. The following rules for avoiding this nerve filament may be given.

- 1 Transverse incisions three-quarters of an inch below the angle of the jaw seldom touch it, especially if the skin is retracted downward and the incision made through the platysma and deep cervical fascia at a little lower level.

- 2 Since it crosses the border of the jaw with the facial artery, incisions made in front of that artery do not touch it.

- 3 Since it goes into the neck at about the anterior border of the sternomastoid muscle, longitudinal incisions half an inch back of that border do not touch it.

- 4 Since it lies on the deep cervical fascia and below the platysma, dissections between these structures should be avoided; incisions should be made through them below the level of the skin incision, and they should be retracted upward with the filament between them.

Careful adjustment of the fascia should be made at the end of the operation, so as to favor repair if any injury has taken place.

The *Sternomastoid Muscle* need not often be divided. Occasionally the nodes cannot well be removed without it, but it is far better to leave it intact if possible. In this series of cases it was divided sixteen times, much less frequently in the later than in the earlier cases. Usually, it has been divided above the insertion of the nerve, in a few instances below the

exit of the nerve. If the case heals primarily a good muscle results, but usually it is for the removal of extensive, adherent, broken-down nodes that its section is necessary, and these are just the cases which heal slowly and leave a depression at the point of healing. The writer has never seen disability or torticollis follow its division.

Injury to the *Thoracic Duct* or one of its branches has been recorded, a rare incident, since tubercular nodes are not often found in its vicinity. Cushing, Schroeder and Plimmer, and Jordan have recorded or compiled fourteen such instances, five of them in operations for tubercular lymph-nodes. There was no serious result in any instance, the single fatality being due to other causes. Six of the cases were treated by packing, six by ligation, and two by suture.

The writer has seen a fifteenth case treated by another surgeon by ligation without ill effect. As treatment, Cushing recommends suture if possible, if not, the passing of a provisional ligature, which may be tightened if the packing does not control the oozing of chyle.

Brinton (Jordan) has shown a preparation in which the duct divided into four twigs, which reunited just before reaching the innominate vein, and anatomists tell of numerous variations in this vessel, a division and reunion of the duct being considered normal by some.

It is probable that in some of the above-mentioned cases branches of the duct, and not the main channel, have been injured.

There is hardly a possibility of injuring the phrenic, pneumogastric, sympathetic, or hypoglossal nerves if one keeps close to the capsules of the nodes. The superficial branches of the cervical plexus may easily be injured, this, however, results in nothing more important than an area of temporary anæsthesia. As has been mentioned, however, one should be careful not to mistake the lower portion of the spinal accessory nerve for one of these branches, and thus cut it.

3 *Details as to Time, Method of Wound Treatment, etc*  
—The operation is essentially slow and tedious. König states that the surgeon who undertakes it should have “iron pa-

tience and plenty of time" The dissection should be carried on with the utmost care, so that no infected nodes need be left behind

In a child under twelve years of age, it is seldom wise to continue the operation for more than an hour at one time. Older patients show no ill effects from much longer operations, two or even three hours. Finkelstein's record of five hours, however, seems excessive.

*Irrigation* of the wound with normal salt solution or a 1 to 5000 mercuric bichloride solution seems desirable. I have seen no advantage follow the stronger solutions which are sometimes advised.

*Drainage* is advisable as a routine measure on account of the increased lymph flow which often follows the section of the lymph vessels. It should, however, be small, a few strands of silkworm gut run under the sternomastoid muscle, and usually brought out through a posterior or inferior opening and tied like a seton. I have never seen a deep phlegmon in a wound drained in this way. The serum, lymph, and blood are quickly carried into the dressing and healing is prompt.

The incisions themselves may almost always be closed at once, excepting for the spots through which the silkworm gut runs. No outside stitch-holes should be made on account of the scars, but, after sewing the divided fascia with catgut, interrupted subcuticular catgut stitches may be taken about half an inch apart.

The *dressing*, which should be bulky, and moist in infected cases, should be changed often enough to keep the wound well drained, usually daily at first.

It may not be amiss to deprecate a far too common lack of supervision when this operation is delegated to inexperienced members of hospital staffs. The writer has known of two such instances where the dissection was followed up for so long a period that the patients never rallied from the operation, and has just seen a third, which was done eight months ago, where there is an extensive recurrence in groups of nodes which were not reached, an ugly, thick, longitudinal scar



where the incision was made, a paralysis from division of the spinal accessory nerve which makes it almost impossible for the patient to get on her jacket, and a lip paralysis which is very annoying, all four of which occurrences happen to be avoidable

### RESULTS

*Early*—There was no fatality from the operation and no serious complication in the entire series of 100 cases, nor in the thirty-four additional cases which the writer has since operated upon. This indication of the safety of the operation has been excelled by other operators, *e g*, Jordan, Wohlge-muth, and Bloss report respectively 429, 167, and 328 cases without operation mortality, and Finkelstein reports 160 cases with one death. There was no mortality in seven of the ten series of cases which Bloss reviews. Fatalities, however, are occasionally heard of, usually following greatly prolonged operations.

Healing was complete in all but four cases at the time of the last reported observation. Two of these had lupus spots which were not completely healed, one was transferred to another hospital on account of diphtheria, and one was removed by his parents while doing well. Aside from these, there are records of 164 operations on the remaining 96 patients, with healing in the first month in 109 instances, in the second month in 43 instances, in the third month in 10 instances, at a later time in 2 instances.

Severe œdema of the face was not noticed in any case, slight temporary œdema was present in about half a dozen cases. There was no evidence that operation disseminated the tubercular infection, but, on the other hand, very strong evidence that it prevented such dissemination.

The patients were almost always out of bed in two to four days and suffered little discomfort while wearing the bandages. The healing in the simple cases was usually complete by the tenth day.

*Later Results*—The particular information which is desired concerning the later history of these patients is (1) how many develop pulmonary tuberculosis, (2) how many de-

velop tuberculosis in other parts of the body, (3) how many have recurrences in the lymph-nodes, (4) what is the general health, and (5) what is the appearance of the neck?

1 In the entire list only one patient has been found to have pulmonary tuberculosis. This patient, aged 29 years, was operated on in January, 1900, for nodes involving the deep cervical chain of the left side. March, 1902, she was found to have extensively enlarged nodes on the other side of the neck, also in the submaxillary region on the side originally operated upon. The site of the original operation was free. She refused another operation. In April, 1904, she was found to have phthisis. In the meantime she had married and undergone the strain of pregnancy, parturition, and lactation.

2 One child developed double tubercular hip disease, which is quiescent, but for which she is still wearing a brace, one developed tuberculosis of the spine, from which she died. Our patient, an adult, developed tuberculosis of the cranial bones.

This showing of only one case of phthisis and three cases of bone disease in the entire series is most encouraging. It indicates the advantage of immediate, thorough operation, the good prognosis which children offer, and the position of the operation as one of the most satisfactory in surgery.

3 The study of lymph-node recurrences brings up a question of definition as to what constitutes a recurrence. It is the rule that patients seen a year after operation show hard nodes on the same side of the neck, usually about the size of beans, sometimes a little larger, sometimes smaller. It is also the rule that these nodes either diminish or remain quiescent. The following cases illustrate this point.

No. 1, aged twenty years, operation, December, 1893, about thirty nodes removed from right side of neck, February 26, 1894, other nodes removed from same side just above clavicle. Two years later there were a few bean-sized nodes in neck and in axilla several filbert-sized nodes. Operation advised and refused. Seen January, 1903. No palpable nodes in neck, and in axilla only one pea-sized node could be felt.

Case 16, boy, aged thirteen years, had a group of tubercular nodes removed from the right side of neck, December 20, 1896.

About eight months later there were bean-sized nodes below and behind the scar, and much larger ones in the left side of neck. Operation advised, but refused. Seen January, 1903, and May, 1904. In vigorous health, with no palpable neck nodes.

Case 91, aged three years. Many tubercular nodes removed from left side of neck, June 1, 1903, December 1, 1904, several filbert-sized nodes on both sides of neck. Removed. Microscopic examination, no tubercle after very careful search.

These cases are cited as examples of a condition which is not infrequent. There have been at least twelve similar ones in the series. The nodes were manifestly hyperplastic, not true recurrences. One must agree with Van Noorden that these small, hard, postoperative nodules cannot be regarded as recurrences. Volland, on examining large numbers of school children in ordinary health, found that more than 90 per cent of them had nodules similar to these.

On the other hand, one can hardly say when any case is really cured, Van Noorden and Bos put the time limit at six years, but the writer has seen one exceptional case of recurrence below the old incision after ten years of quiescence. In this series, therefore, those cases who have a few hard nodes in the neck which are apparently quiescent are classed as *apparently cured*.

Hard, apparently quiescent filbert-sized nodules are classed as *uncertain*.

The cases may be best studied in groups according to period of observation, the long observed cases being manifestly the more important.

Group I—Nineteen cases followed six to eleven years.

Fifteen were apparently in perfect health without palpable nodes or with a few not larger than beans.

One whose neck was well, still wore a brace for tubercular coxitis.

One had a small area of lupus on neck.

One had three or four filbert-sized nodes which had been quiescent two years.

One whose neck is now apparently free, had a few recurrent nodes removed only two months ago.

Seven of the patients had operations during the period of observation, four of them on the other side of the neck

Group II —Nine patients followed into the sixth year

Eight are apparently well and free from recurrence

One, an adult, had nodes removed from below the site of the scar ten months after the first operation, from the other side of the neck nine months ago, and now has a recurrence near the site of the last operation

Only two patients in this group had secondary operations, one just mentioned, the other has had repeated operations, the last one seventeen months before this report, and is now very vigorous, strong, and without apparent recurrence

In this group reference may well be made to patient No 22, whose operation was March 4, 1898 At that time he was a very tall, slender young man of 18, with enormous nodes in his neck, believed by friends and physician to be rapidly declining from tuberculosis He has lived in Colorado and Utah since his operation, has never had a recurrence, has been continually in active business He now seems in perfect health, and has recently passed his physical examination, and been granted a large life insurance policy

Group III —Seven patients followed into the fifth year  
Four are now apparently in perfect health

One, apparently in perfect health now, had an operation for a recurrence on other side of neck only eight months ago

One has a few quiescent filbert-sized submental nodes

One has phthisis and nodes on other side of neck, site of original operation free

Two of these patients have had recurrence below the incisions, one on the opposite side of neck

Group IV —Eight patients followed into the fourth year  
Six are apparently perfectly well

One, apparently perfectly well, had an operation for a recurrence below scar one and a half years ago

One has quiescent filbert-sized submental nodes, otherwise well

Only one case in this group had a secondary operation

Group V —Thirteen patients followed into the third year

Seven are apparently well

Two have had operations for recurrences, respectively, one year and ten months ago

Three have recurrences in neck

One has died of tuberculosis of spine

Group VI—Twenty-six patients followed into the second year

Twenty-one are apparently well

One is now apparently well, but had secondary operation one and a quarter years ago

One has a single filbert-sized hard node in other side of neck, a few bean-sized nodes in both sides

Two have small lupus spots

One has tuberculosis of skull bones

Only two of these patients had secondary operations

Group VII—Six patients followed into the first year

Five apparently well

One died of acute endocarditis a few weeks after leaving the hospital

Group VIII—Twelve patients not seen after leaving hospital

Eleven left the hospital apparently well, with healed wounds

One was transferred to Willard Parker Hospital before wound healed

If tabulated, the record is as follows

TABLE SHOWING THE RESULT BY YEARS

Period of Observation	6 to 10 years	6th year	5th year	4th year	3d year	2d year
Number of Cases	19	9	7	8	13	26
Apparently cured	15	8	4	6	7	21
Filbert sized nodules, diagnosis doubtful	1		1	1		1
Recurrent nodes		1			3	
Apparently well now, but have had recent operations for recurrences	1		1	1	2	1
Tubercular hip, neck well	1					
Lupus	1					2
Phthisis			1			
Tuberculosis of cranium						1
Died of tuberculosis of spine					1	

## Stated in percentages

Observed over 6 years, 19 cases	Per Cent
Apparently cured	79
Filbert-sized nodes, diagnosis doubtful	5 2
Neck apparently well, but recent operations for recurrence	5 2
Neck well, but tubercular coxitis	5 2
Lupus spot	5 2
Observed over 3 years, 43 cases	
Apparently cured	76 7
Filbert-sized nodes, diagnosis doubtful	7
Neck apparently well, but recent operation for recurrences	7
Recurrent nodes	2 3
Neck well, tubercular coxitis	2 3
Lupus	2 3
Phthisis	2 3
Observed over 1 year, 82 cases	
Apparently cured	74 4
Filbert-sized nodules, diagnosis doubtful	5
Apparently well now, but have had recent operation for recurrences	7 2
Recurrent nodes	5
Neck well, tubercular coxitis	1 2
Lupus	3 6
Phthisis	1 2
Tuberculosis of cranium	1 2
Died from tuberculosis of spine	1 2

If we compare the adults in this group with the children, we have the following percentages

Over 20 years of age, 14 cases	Per Cent
Apparently cured	57 2
Filbert-sized nodes, diagnosis doubtful	7 1
Recurrent nodes	21 3
Phthisis	7 1
Tuberculosis of cranium	7 1
Under 20 years of age, 68 cases	
Apparently cured	77 9
Filbert-sized nodes, diagnosis doubtful	4 4
Apparently well now, but have had recent operations	8 8
Recurrent nodes	1 5
Neck well, tubercular coxitis	1 5
Lupus	4 4
Died from tuberculosis of spine	1 5

It is probable that some of the patients who are classed in these tables as "apparently cured" will at a later time show further tubercular inflammation, and that some of those who now have evidences of tuberculosis will eventually be cured, but the tables represent the condition of the patients so far as it could be learned

In view of these observations, it seems fair to make, to patients with this disease or to their friends, the assurances stated in paragraph 5 of the summary

### SUMMARY

1 Tuberculosis of the cervical lymph-nodes is apparently due to infection received from the fauces, pharynx, or nasal mucous membrane, in the great majority of cases (86 per cent in this series)

2 The disease shows a tendency to extend to the lungs and other internal organs Statistics indicate that such extension occurs in one-quarter to one-half of the cases from whom the nodes are not removed

3 Entirely apart from its tendency to infect other organs, the disease is very tedious, causes great discomfort and disability, and leaves disfiguring scars

4 The thorough removal of the diseased nodes by operation has given better results than any other method of treatment which the writer finds recorded

5 The records of operations justify the following assurances (a) In favorable cases Safety of operation (many operators reporting more than 100 cases without mortality), a scar which is hardly to be seen, probable confinement to bed of two or three days, the wearing of a bandage or dressing from one and a half to three weeks, freedom from recurrence in about 75 per cent, and ultimate recovery in about 90 per cent of the cases

(b) In the less favorable cases safety of operation, less disfigurement from scars than discharging sinuses will cause, freedom from recurrence in 50 to 55 per cent, and ultimate cure in 70 to 75 per cent of the cases

6 Transverse incisions, either in the neck-creases or parallel to them, are usually to be used. They should be so placed that the fibres of the facial nerve will not be cut. A vertical incision back of the hair-line is occasionally helpful. Extensive incisions are necessary for the far advanced cases.

7 Every precaution should be taken to preserve the normal structures of the neck.

8 It is not feasible to divide the cases into groups, some suitable, others unsuitable for operation. Every case with tubercular cervical lymph-nodes should be operated upon unless there is a particular reason to believe that the operation would not be endured.

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# DRAINAGE IN DIFFUSE SEPTIC PERITONITIS<sup>1</sup>

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THE term diffuse septic peritonitis as employed in this article refers to an acute septic inflammation of the peritoneum so wide-spread in extent as apparently to involve its entire surface, and which is accompanied by marked changes in the appearance of the membrane and in the quantity and quality of its fluid contents. The division of wide-spread acute peritoneal infections into two or more forms seems both cumbersome and unnecessary, as all the cases seen by me have presented the same general characteristics, varying only in degree.

This variety of peritonitis is usually due to perforation of some of the hollow viscera, with extravasation of septic material into the general peritoneal cavity. The rapidity of the process depends upon the nature of the infecting medium and upon the point at which it is released. Perforation of the stomach or duodenum is followed more rapidly by symptoms of a spreading peritonitis than a perforation of equal size taking place in the pelvic portion of the digestive tube, because gravity quickly carries the infection across the entire peritoneal cavity from top to bottom, while from the low perforations this wide-spread soiling must be brought about by the slower but no less certain agents, peristalsis and absorption.

In the class of cases under consideration the peritoneum is found everywhere deeply congested. Some portions have begun to lose their lustre, while others are already roughened and lustreless. Patches of fibrin are scattered promiscuously over the surface, and here and there may be found slight adhesions between the intestinal coils. The fluid contents of the peritoneum are usually much increased in quantity, but in some cases seen early this increase will be found to be less than the gravity of the symptoms would indicate. Serum no longer,

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<sup>1</sup> Read before the Chicago Surgical Society, March 6, 1905

the fluid will be found of varying consistency and color. At times it appears as pure pus, at others thin and of a greenish tinge. Again, and especially when less than the usual amount of fluid is found, it will be brown in color. In some cases the entire cavity seems fairly well filled. In others the fluid will be found occupying the various fossæ and the cul-de-sac.

Previous to the year 1900, the surgical treatment of diffuse septic peritonitis was attended by results which tended neither to establish it as the method of choice nor to furnish an agreeable retrospect for those of us who now "know better."

With a mortality rate approaching 100 per cent, these cases were viewed with dismay by the surgeon. Better knowledge of the etiology and pathology of the condition demanded that the patient be given the chance for life which surgery alone could offer, but the knowledge necessary to the proper application of this means of relief was acquired more slowly and at tremendous cost. Actuated by a sense of stern duty, regardless of consequences to himself or to his professional reputation, the surgeon operated upon such cases as were not actually moribund, employing the methods which at the particular time were accepted as correct, and was then compelled in most instances to watch the steady and relentless progress of the disease to a fatal termination.

During this period of discouraging experiences we gladly welcomed and eagerly adopted any suggestion as to the management of these cases which seemed rational, and which had in the experience of a trained operator proved even of slight benefit. Within a comparatively brief period the following procedures were advanced and more or less generally applied by the surgical world in the effort to conquer the dread disease.

The cleansing of the peritoneum by evisceration and dry sponging. By dry sponging without evisceration. By copious irrigation of the entire sac at the time of the operation. By continuous irrigation maintained for hours or days after operation. By more or less limited irrigation applied to the region

from which the infection originated By simply affording an outlet for the escape of pent-up, septic fluid, making no further effort to hasten its removal

The attempt to drain the peritoneal cavity into the intestine by introducing through a trocar large quantities of saline purgatives into the small intestine at the time of operation

Capillary drainage by multiple or single strands of iodoform gauze, then plain gauze, then wicking, then the cigarette drains large and small, one or many

Glass drainage-tubes, large and small, straight or crooked, inserted here and inserted there

Rubber drainage-tubes of all sorts and sizes used with or without gauze The wound was left wide open filled with gauze drains, was partly closed about the drains or was closed tightly with no drainage Counteropenings for drainage were made in the loin and flank Careful dissection of the male perineum to permit the passage of a tube into the lower pelvis was recommended Vaginal drainage, by tube or gauze or both, also belongs to the list Then we find ourselves attempting to drain this septic area into the already choking lymphatics of the sufferer by raising the foot of the bed and flooding the diaphragmatic or absorbent area of the peritoneum with the contained septic fluids

The variety of methods above mentioned as well as the many opposing principles represented by them graphically portray the unsettled and dissatisfied state of the surgical mind regarding the treatment of this disorder

In 1900, Dr George Ryerson Fowler, of Brooklyn, published an article describing postural postoperative treatment of diffuse septic peritonitis The article above mentioned marked a new area in the history of this disease, supported as it was by the records of nine consecutive cases which recovered Never before had any one been able to report such a series of successes in its treatment, and, in fact, it is questionable whether so many recoveries had up to this time occurred in the practice of any one man To most of us the description of the elevated head and trunk posture came with

telling force We had so long and patiently tried the various exploited methods of combating diffuse septic peritonitis, with such distressingly unsatisfactory results, that the vista thus suddenly opened before us seemed too good to be true

As has been shown by Fowler, Clark, and others, absorption takes place most rapidly from the diaphragmatic peritoneum, particularly around the central tendon of the diaphragm, and the absorbent qualities of the membrane steadily diminish from this point downward, until, in the lower pelvis, we find that a localized septic process may exist for many days without exciting much constitutional disturbance

In view of the fact that the position advocated by Fowler accomplishes what common sense should dictate in the light of our knowledge of the physiology of the peritoneum, we wonder that its employment was not sooner urged In our work involving the treatment of septic processes, we strive unceasingly to accomplish, as completely as possible, their localization to the part first attacked, and to provide for the products of infection the freest external drainage The treatment of peritoneal infections offers no exception to the above general rule, and, in my judgment, the greatest advance yet made in the furtherance of this treatment is the elevation of the head and trunk, thereby draining the high and extremely dangerous area of the cavity, with its numerous mouths, large, wide open, and hungry for septic material, into the lower and safer area where absorption through lymph channels will not take place more rapidly than will the escape of the poison through well placed external drains

The results following any method of treatment of diffuse septic peritonitis will be more or less dependent upon several factors, among which may be mentioned the nature of the infection, the resistance of the patient, and the length of time elapsing between the onset of the peritonitis and the operation The nature of the disease will ever cause it to be classed among the most formidable of acute surgical disorders

Believing fully that free drainage of the infected peritoneum is the essential factor in its successful treatment, I

desire to briefly describe the technique which I have employed since December, 1902, at which time a preliminary report was made

Since the above date nineteen cases of diffuse septic peritonitis have been operated upon with seventeen recoveries and two deaths. Ten of the cases were of appendicular origin, one following perforation of a duodenal ulcer, one following perforation of a gastric ulcer, one due to rupture of the gall-bladder, two to ruptured pus-tubes, two following rupture of a suppurating ovarian cyst, and two were cases of postoperative peritonitis, one following an abdominal hysterectomy, the other following an appendectomy. Of the fatal cases one was of appendicular origin and the other due to rupture of a large suppurating ovarian cyst. These were all cases of diffuse septic peritonitis, involving, so far as could be seen, all of the peritoneal surface, characterized by the local changes described early in the paper and by the presence of symptoms of extreme gravity. No cases of peritonitis, even of a severe type which were more or less localized, are included in the list. (It may, however, be stated that during the period in which these cases were operated upon some cases of diffuse septic peritonitis were seen in which operation was refused because the patients were moribund.)

In all cases of diffuse septic peritonitis the incision should be ample, and should be made in the median line, the better to facilitate the thorough cleansing of the cavity. When the infection is due to contamination from the upper abdominal viscera, the incision will of course be made above the umbilicus.

The first step will be to find the source of the infection and to prevent further soiling of the cavity by making immediate and thorough repair of the diseased part or parts. A two-inch incision is then made in the median line just above the symphysis, and through this a large rubber tube, one to one and one-half inches in diameter, split from end to end and carrying a gauze wick, introduced to the bottom of the pelvis. In females the posterior cul-de-sac is freely opened into the vagina, the lower abdominal incision rendering its accomplishment possi-

ble in a moment, and a similar tube without the gauze wick introduced through the cul-de-sac into the vagina. The abdominal cavity is now thoroughly washed out with gallons of hot salt solution, care being taken to reach all the fossæ and areas where septic fluid may lie more or less concealed. The upper incision is then rapidly closed with through-and-through sutures. Before tying the last stitch, enough of the saline solution is introduced through a funnel to entirely fill the abdomen. The lower wound is left open, and in males an additional tube similar to the first, but without the wick, is introduced to the bottom of the pelvis alongside the first. The patient is then raised while yet on the table to the sitting posture, which is maintained while transferring him to the bed. He is placed still in the sitting posture in the bed, the head of which has been raised from twenty-four to thirty inches from the floor.

The dressings require close attention and frequent renewal, as drainage for the first few hours will be most profuse. When the solution left in the abdomen has escaped and drainage is becoming scanty, the fluid, which in males tends to accumulate in small quantities in the lower point of the pelvis, is pumped out every two hours through the plain tube, thus decreasing the demands upon the capillary drainage furnished by the mixed drain of tube and gauze. In females no such accumulation occurs, as the vaginal drains tap the lowest point of the peritoneal sac. This pumping-out process may usually be discontinued at the end of twenty-four hours. All tubes may be withdrawn, as a rule, in from five to eight days, depending upon the indications of the particular case.

For infections originating in the lower abdomen or pelvis, the incision is made below the umbilicus, extending to the symphysis. Having effectually dealt with the source of the infection, the abdomen is thoroughly flushed out, as described above, the drains placed in the same manner and the wound closed down to the tube, or tubes, never, however, so closely as to choke them. The subsequent management is exactly the same as that above detailed.

I believe that leaving in the abdominal cavity a large amount of salt solution exercises a very valuable influence, as this, owing to the elevated head and trunk posture, establishes a strong drainage current in the right direction, *i e*, towards the lower pelvis, where it is easily and rapidly taken care of by the ample drains provided

The indiscriminate and promiscuous introduction of gauze or tube drains here and there in various directions throughout the cavity is considered not only as a useless but a really harmful practice. Such drains are rapidly shut in by adhesions, drain nothing, and greatly increase the danger of postoperative obstruction

The lowest point of any cavity is the logical point to drain, and when, by posture, we insure the gravitation of the abdominal fluids to the lower pelvis, free drainage at this point is both necessary and sufficient

As to drainage material I have discarded all forms but two. When a capillary drain is required, the combined tube and gauze drain, consisting of a soft rubber tube at least one inch in diameter, split from end to end, and carrying a wick of iodoform gauze which fits loosely its lumen, is employed. When capillary drainage is not demanded, as, for instance, in the vaginal drains, a similar tube without the wick is used. These drains are always available, are easily introduced, conform to the shape of the drainage track, and last, but not least, they are very easily withdrawn

Since adopting the technique above described, the mortality of this disease has in my hands been reduced from 90 per cent to 11 per cent approximately. Included in the list of cases reported in this article are two of diffuse, septic, postoperative peritonitis, both of which recovered. So far as I am aware, but very few recoveries have been recorded following the treatment of postoperative peritonitis by any plan, active or passive, and I wish to reaffirm a statement made in a former article upon this subject in December, 1902, that by this method of treatment these cases of postoperative peritonitis formerly considered hopeless have been transferred from the hopeless to the hopeful class



In conclusion, I should like to emphasize the following points

1 Operations for diffuse septic peritonitis should be made as quickly and with as little manipulation as is compatible with thoroughness

2 Evisceration, partial or complete, greatly increases shock and the prospects of a fatal result

3 The generous use of clean, hot water will most thoroughly cleanse the infected cavity with the least traumatism

4 Drainage is simplified by collecting the peritoneal fluid at one point where drains may be easily placed The elevated head and trunk posture followed by the gravitation of fluid to the lower pelvis best accomplishes this

5 Results following the surgical treatment of diffuse septic peritonitis will be improved should each individual operator adopt some definite form of procedure in such cases, which, being well understood by operator and assistants, may be methodically, speedily, and thoroughly carried out

# PENETRATING BULLET WOUND OF ABDOMEN PASSING THROUGH THE SPLEEN, STOMACH, VERTEBRA, AND SPINAL CORD.<sup>1</sup>

LAPAROTOMY AND SUTURE OF STOMACH WOUNDS, RECOVERY SUBSE-  
QUENT LAMINECTOMY AND REMOVAL OF BULLET FROM  
SPINAL CORD, RECOVERY

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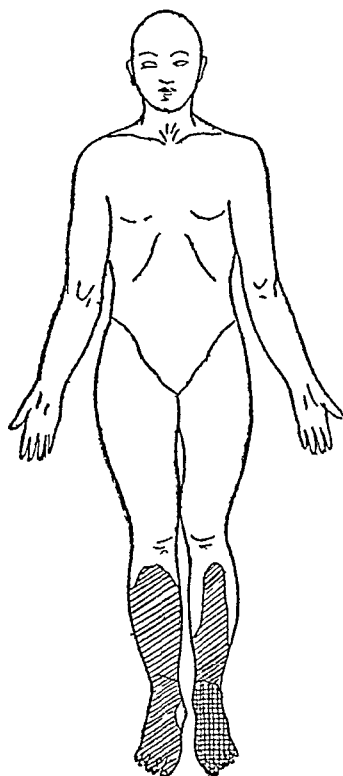
Surgeon to the Rhode Island Hospital

ON July 11, 1904, at 7 45 A M , Mrs J A , twenty years of age, was shot at close range with a 32-caliber revolver, while walking on the street The bullet entered the left side of the body at the level of the eighth rib She was immediately taken to the Rhode Island Hospital by the ambulance in a state of collapse On admission physical examination showed a well-developed and fairly well nourished young woman The skin and mucous membranes were very pale The pupils equal and slightly dilated The heart and lungs were examined hurriedly and found negative The wound of entrance made by the bullet was found on the left side of the trunk over the eighth rib, in the anterior axillary line, surrounded by an area of burnt and discolored skin roughly three inches in diameter The abdomen was tender on palpation There was no dulness in the flanks, but marked rigidity of the abdominal muscles There was complete motor paralysis of both lower extremities, though the patient could move both thighs a trifle, probably owing to the ability to use the psoas muscle Both lower extremities were hyperæsthetic, even the weight of the bed-clothing being painful, with the exception of an area on the left leg supplied by the fourth lumbar nerve, which was anæsthetic The pulse was rapid and of poor volume and tension The bladder was catheterized and normal urine obtained The patient was taken to the operating room for operation, which was begun at 9 30 A M A vertical incision through the abdominal wall, roughly six inches in length, along the outer border of the

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<sup>1</sup> Read before the Rhode Island Medical Society, March 2, 1905

left rectus, was made. This wound was later enlarged by a second incision from about its centre running outward and downward and to the left for a distance of about three inches. The muscles of the abdominal wall were separated in the direction of their fibres. The abdominal cavity was full of fresh and clotted blood. The bullet was found to have passed through the lower border of the spleen, the mesocolon, cutting a branch of the splenic artery,



■ Anaesthetic

▨ Delayed sensation

FIG 2—Areas of abnormal sensation, February 8, 1905

from which the hæmorrhage had come, and which was still bleeding freely, in and out of the posterior surface of the greater curvature of the stomach, but no opening in the vertebra could be felt. No great amount of stomach contents was found in the abdominal cavity. The bleeding vessel in the mesocolon was tied with catgut. The openings in the stomach wall were closed with

Fig. 1—50 mph showing relation of bullet to first human victim





a purse-string suture, over which were placed Lembert sutures of black silk. The spleen was not bleeding, and the wound in it was left alone. The abdominal cavity was flushed out with saline solution and a good-sized iodoform gauze drain left in leading to the rupture in the stomach wall. The bleeding was apparently controlled by ligation of the bleeding artery in the mesocolon. The abdominal wall was closed in layers with black silk. The patient stood the operation well, and was given 1200 cubic centimetres of saline intravenously during the operation. She made a good recovery from the ether. Pulse was rapid but fairly good throughout the night. She had considerable paroxysmal pains in the knees during the night, requiring one-sixth grain of morphia subcutaneously. The day following the operation the anæsthesia on the left leg had disappeared.

The second day she complained of numbness in the legs and was able to move the toes. She was very thirsty, and was allowed one drachm of water every hour.

On the fourth day she was allowed one-half ounce of milk every hour.

On the fifth day involuntary micturition appeared for the first time.

On the sixth day a small bed-sore appeared over the sacral area, and she had involuntary bowel movements.

On the seventh day the wick was removed from the abdominal wound, and considerable pus escaped from behind it. Patient again complained of pain in the legs and also in the bladder region, which seemed to be relieved by frequent catheterization.

On the ninth day a soft egg on toast was added to the diet. There was a moderate amount of pus from the wound. Leucocyte count showed 16,400.

On the tenth day an X-ray was taken, being an anteroposterior view of the body. This showed a bullet in the line with the body of the first lumbar vertebra pointing up. Leucocyte count 17,680. Ability to move the legs was increasing, but the patient did not move the left as well as the right.

On the sixteenth day a second X-ray was taken, the light being thrown from the side at a definite angle. This showed a bullet apparently lying in the spinal canal. The pain in the legs extreme. Leucocyte count, 16,200.

On July 30, or nineteen days after the shooting, a laminectomy was performed with the hopes that the removal of the bullet might be followed by relief of her distressing pains, and to a certain extent her paralysis. The patient was placed face downward on the table. An incision about five inches long was made in the median line, between the eleventh dorsal and the fourth lumbar vertebræ. The muscles and fascia were dissected away from the spinous processes and laminae of the vertebræ on either side. Bleeding was controlled chiefly by packing each side of the spinous processes with gauze for a couple of minutes. With the idea in view of trying to save the long spinous ligament in order not to weaken the back too much, the following operation was planned and carried out. First the spinous processes of the twelfth dorsal and first and second lumbar vertebræ were split longitudinally, with a thin-bladed saw, down to the laminae. The supra- and interspinous ligaments were then split longitudinally with a knife, this division making a straight line with the division of the spinous processes. Next the spinous processes were severed from the laminae with a heavy wire cutter shaped like a blacksmith's tongs. In order now to get at the laminae and still preserve the ligament so that it could be replaced, I severed each half of the split ligament at opposite ends after the manner of tendon lengthening. These two halves of the ligament, including the halves of three spinous processes, were then turned out on either side and the spinal canal opened in the usual manner (Fig 4). The bullet lay under the lamina of the twelfth dorsal vertebra in the right posterior quadrant of the spinal cord, which latter must have been traversed by the projectile and was considerably lacerated. The bullet was easily seen and removed without further disturbing the cord. A drain of plain gauze was led down to the rent in the meninges, which I made no attempt to close. The two halves of the supraspinous ligament were reapproximated and sutured with black silk, restoring its continuity. The muscle and skin incisions were closed with black silk sutures, leaving a small opening for the drain. The patient stood the operation as well as could be expected. She was put to bed on a Bradford frame face downward. She made a good recovery from ether.

On the second day after the laminectomy voluntary control of the *tibiales antici* was noted to be present, but weak. She moved the right quadriceps and adductors. The same held true of the

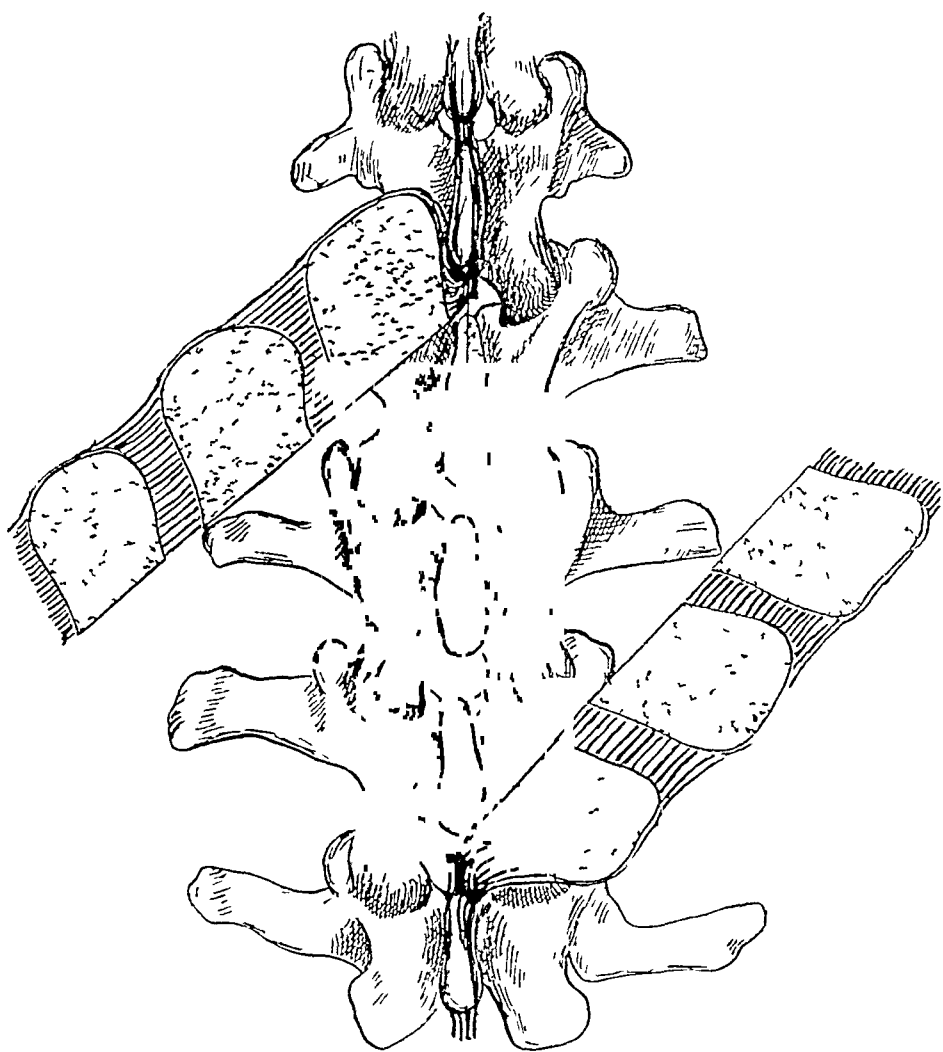


FIG. 4.—Showing method of splitting spinous processes, the supra and interspinous ligaments, before cutting away the laminae





left side, except that the impulse was weaker and the quadriceps extensor did not respond

On the third day she complained of itching of the skin of the abdomen and legs and pain in the left knee

On the sixth day the sutures were removed from the back and she was turned onto her back, as she could not bear the stomach position

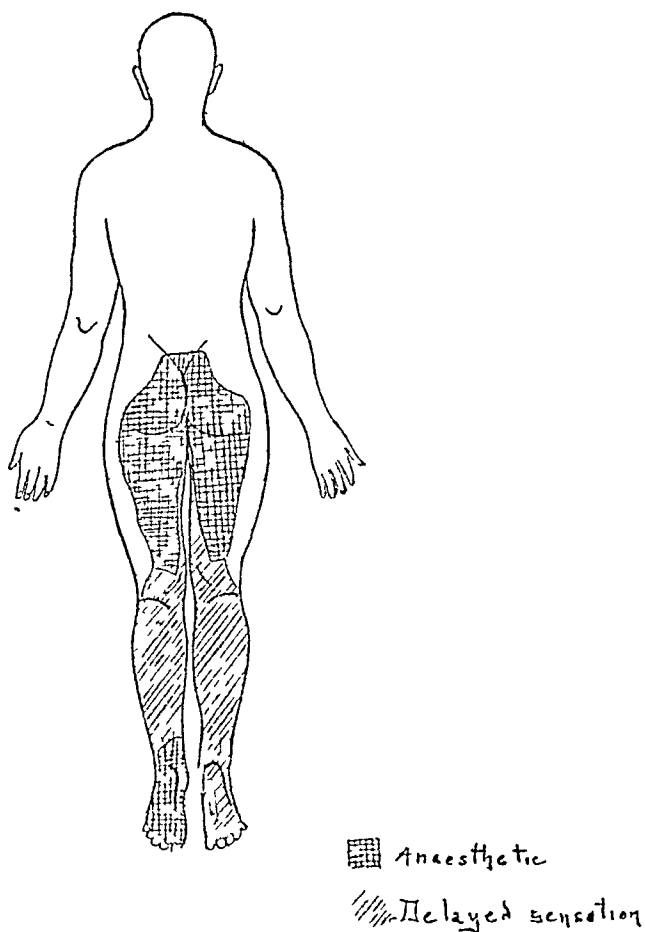


FIG 3—Areas of abnormal sensation, February 8, 1905

On August 18, or thirty-eight days after she was shot, the abdominal wound was entirely healed, but there still persisted a small sinus in the incision in the back. On this day she was sent out of doors in a go-cart on a Bradford frame

On August 22, or the twenty-third day after the laminectomy, a plaster jacket was applied, and the patient was able to go out of doors in a wheel-chair for three hours. She was much more comfortable with the jacket on

On August 31, having been out of doors daily since the jacket was applied, she was allowed to go home in the ambulance. She was at this time running a little temperature, but the pain in the legs was the symptom most complained of.

The history since leaving the hospital has been one of gradual convalescence. For the first six weeks after returning home the patient suffered much pain periodically in her knees and legs, with occasional and sometimes frequent pains in her bladder. The bed-sore over the sacrum was very resistant, but finally healed towards the latter part of November. The plaster jacket was removed after it had been on three weeks because the continual dribbling of urine soaked into the plaster and made it offensive. There has been no complaint of any pain in the back at the site of the laminectomy wound, which healed per primam, except for a slight sinus caused by the wick to the spinal cord, which persisted for a number of days and then closed. Since the middle of October, when the patient made a marked change for the better, convalescence has been rapid. She gained in weight and in ability to move her previously paralyzed muscles, and there has been a gradual subsidence of pain in both legs and bladder. There was noticed at this time also an ability to hold her water for several minutes at a time, but when the desire came the urine was passed before she could dispose of it properly. She was up in a wheel-chair daily. By the 1st of November she took a few steps each day with a member of her family on each side to support her, and by the 1st of December she was able to get about on crutches.

On December 18 she took a few steps alone without any support. At the present time she can walk alone, though her muscle power is still too weak for very much exertion. She may be said at this time to have regained almost complete control over her vesical sphincter, though at times this is apt to demand hurried attention. The bowels move, though they usually require enemata.

February 8, 1905, Dr George L. Shattuck kindly tested the skin sensation of both lower extremities. He found a more or less saddle-shaped area of anæsthesia to tactile and temperature sense. This was quite symmetrical, starting on the sacrum behind and curving outward towards the trochanters, and then turning downward and involving the posterior surface of the thighs as far as the upper border of the popliteal spaces. This

area of anæsthesia then involved the inner part of the thighs, including the labiæ. The whole surface of the left foot, including the ankle, and a narrow strip on the right sole were anæsthetic. Everywhere else on both extremities, with the exception of the anterior surface of both thighs as low as the tibial tubercles, sensation was delayed though present. All muscles of both lower extremities gave the reaction of degeneration. Though sensation was delayed or altogether lost in places and normal in others, there were no sharp lines of demarcation to correspond with the distribution of any one nerve. A transverse myelitis must have been set up by the injury to the cord, caused by the passage through it of the bullet in order to produce the paralysis of the bladder sphincter, noted for the first time on the fifth day after the injury was received. The recovery from this lesion is of necessity a slow one, but if the patient continues to regain her lost functions at the present rate of progress, I believe we may look for a disappearance of almost all motor and sensory disturbances.

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# SOME REMARKS ON CASES INVOLVING OPERATIVE LOSS OF CONTINUITY OF THE COMMON BILE DUCT

WITH THE REPORT OF A CASE OF ANASTOMOSIS BETWEEN THE HEPATIC DUCT AND THE DUODENUM

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IN 1100 operations upon the gall-bladder and bile passages which have occurred in the hands of Dr Charles H Mayo and myself up to March 27, 1905, 159 were upon the common duct of the liver, and of these latter seven have involved complete loss of the continuity of the common bile duct as a direct result of the operation, five were intentionally produced in the attempt to remove a malignant neoplasm, one was accidentally caused, and one followed an extensive operation for gall-stone disease. The latter forming the case reported in detail.

The possibility of union between the divided ends of the common duct was first brought to our attention in an unfortunate manner. During the removal of a deeply situated and densely adherent gall-bladder, the common duct was accidentally divided. The ends were widely separated before the accident was discovered, rendering detection of the distal end a matter of some difficulty. The proximal fragment was easily identified by the escape of bile. The common duct was of normal size, which rendered suturing difficult and uncertain. It was accomplished in the following manner: three catgut sutures were placed in the remnants of peritoneum, adhesions, and right margin of the gastrohepatic ligament, drawing the duct ends into apposition, five fine catgut sutures were then introduced through all the coats of the common duct throughout three-fourths of its circumference, leaving a gap anteriorly for drainage. We simply reproduced as nearly as we could the

condition which exists after choledochotomy for stone. The external bile discharge ceased in sixteen days, patient discharged on the twenty-second day, and has had no further trouble, now nearly two years.

This instance taught that fine catgut would hold a sufficient time for union to take place, and was not open to the objection to silk in the latter's liability to secondary stone formation, such as occurred in the reported case of Homan's. It also demonstrated that no harm followed taking all the duct coats firmly in a single suture.

Within a year we had an opportunity to apply the same technique to a case of carcinoma of the gall-bladder which extended down the cystic duct to the common duct, and in which the gall-bladder, cystic duct, and three-fourths inch of the common duct were excised. In this case the second portion of the duodenum was loosened from its bed after the manner of Kocher in his gastroduodenostomy, the intestine was drawn to the right and held by catgut sutures to the neighboring tissues. The patient made a good recovery and remained well until a return of the growth thirteen months later (*Medical Record*, April 30, 1904).

The condition of the third case was due to a small, very hard, malignant growth in the common duct causing obstructive jaundice. The tumor and nearly an inch of the common duct was excised and the ends sutured as in Cases I and II. The patient, however, died from capillary hæmorrhage on the third day, without fully recovering from the initial shock.

Our first attempt at direct union of the common bile duct to the duodenum came about through an effort to remove, what we supposed at the time to be, a stone impacted in the common duct, just in the margin of the pancreas and underneath the edge of the duodenum. The duodenum was loosened on its right side, turned upward and to the left. The duct was incised and the supposed stone found to be a typical duct carcinoma, hard, grayish white, and well defined. It was excised and the space closed by catgut sutures. The common duct was reinserted at a new location in the duodenum, at a

point where it was covered by peritoneum, after the plan so successfully used by Halsted, catgut was again used as a suture material. A wick drain was inserted down to the suture line. This was a mistake. There was no leakage until the drain was removed, which did not take place until the end of a week. The plastic lymph, which should have protected the suture line, became entangled in the meshes of the gauze, causing difficulty and delay in removal, and so disturbed the union as to allow a minute fistula to form. This gradually increased in size from the biliary and duodenal discharge until the patient was exhausted and died at the end of the eighth week. The lesson taught was that a gauze drain should never be placed directly against an anastomotic suture line. The feasibility of union between the duct and the duodenum at a peritoneal covered situation was manifest by the temporary recovery of the patient.

The fifth case was reported in conjunction with a paper on cholecystectomy at the meeting of the American Medical Association, Surgical Section, 1900 (*The Journal*, December, 1900). In this patient we excised the cancerous gall-bladder with a tongue-like overlying portion of the liver, together with the whole of the cystic duct and part of the common and hepatic ducts. An unsuccessful effort at union of the deep duct was made. The operation was very easy from the fact that the liver was exceedingly movable and the ducts elongated. All the bile escaped from the external wound, to the great distress of the patient, until death occurred nine weeks later.

The sixth case, which concerned the successful removal of a carcinoma of the papilla and diverticulum of Vater, was reported in the *St. Paul Medical Journal*, June, 1901, but has no bearing on the subject under discussion.

The writer has most briefly reviewed some features of these cases to illustrate a few facts which experience teaches and which may be summarized as follows: first, the common duct may be united end to end, by through-and-through catgut sutures. It is essential that a few supporting sutures should be placed in the surrounding tissues, and that a portion of the

circumference of the line of union be left open for relief of tension and drainage. Second, the common and in certain cases the hepatic, duct may be implanted into the duodenum, provided a peritoneal covered portion of the intestine be chosen for the purpose. Third, to facilitate these operations, the second portion of the duodenum should be loosened and drawn to the right and held by fixation sutures, preventing tension on the duct suture line. Fourth, drainage, if necessary, should be pliable, covered with rubber tissue, and placed as distant to the suture line as will serve the purpose of protection against leakage.

In the following case the successful outcome was due to the care with which we were able to carry out these details.

CASE VII—*Cholecystectomy and Choledochotomy followed by Extensive Stricture of Common Duct which was relieved by Secondary Anastomosis between the Hepatic Duct and Duodenum*—Mrs L. I., aged twenty-two years, mother of two children, admitted to St. Mary's Hospital, June 30, 1903, with the following history. For four years has suffered with "stomach cramps" and pain in right hypochondrium which passed through to the right shoulder. In one of these attacks she had been slightly jaundiced. Ten days ago an attack similar to the previous ones came on, but did not stop as before. The intense pain subsided, but was replaced by frequent colicky pains, nausea, chills, and fever. Stools were clay colored. Family and personal history other than above, negative. Examination, a slightly built woman five feet two inches in height, weight, ninety-eight pounds, heart and lungs, normal, urine contained bile, a trace of albumen, and a few hyaline casts. A moderate leucocytosis was present, temperature, 101° F, pulse, 110, icterus fairly well marked, deep pressure over gall-bladder region during inspiration developed resistance and an indefinite sense of tumefaction. No other relevant physical findings. Diagnosis, gall-stones in gall-bladder and common duct. Operation, July 1, 1903. Through a four-inch straight incision in upper right rectus muscle a contracted, thick walled gall-bladder filled with stones was exposed. The superior angle of the incision was carried upward and inward along the costal margin, after the method of Bevan, and the common duct palpated and inspected.



It was full of stones and debris and closely adherent to the duodenum and surrounding structures. The gall-bladder was removed from below upward without opening its cavity. The cystic duct was slit downward into the common duct, which was freely opened. The common duct was dilated to the size of a lead-pencil and filled with putty-like material and stones, all of which was removed with a scoop. During the process, dark, flocculent bile appeared. The cleaning process was difficult, and when completed the duct was seen to be greatly thickened and the mucous membrane eroded. A few interrupted catgut sutures were introduced in the incised duct up to the entrance of the cystic duct. At this point an opening was left into which a fish-tailed rubber tube one-quarter of an inch in diameter was introduced and held by two fine catgut sutures. Around this a moderate amount of gauze was placed and protected by gutta-percha tissue, the whole being allowed to protrude from the upper angle of the abdominal incision. The operation lasted three-quarters of an hour. Patient reacted well, but was in a rather critical condition for several days, until normal bile in quantity made its appearance. Drains all out on the eleventh day, patient discharged on the twentieth day with a healed wound, bile freely present in the stool.

Readmitted May 25, 1904. Patient stated that for about five months she had been quite well, doing her housework, and had gained ten pounds in weight. About this time noticed some general skin pruritus, slight jaundice, and an unpleasant sensation in the stomach. This rapidly increased, and was followed by chills and fever, clay-colored stools, and severe illness. She was in bed for five weeks, eventually, the old drainage tract in the former incision opened up and discharged bile freely, with marked improvement. From that time until admission, the fistula discharged at intervals with temporary betterment. The periods during which the fistula remained closed were marked by severe symptoms, jaundice, nausea, chills, and fever. At the time of readmission fistula was not open. Patient emaciated, weight eighty-one pounds, jaundice extreme, chills, fever, and sweating, with colicky pains of daily occurrence. Pulse-rate, 120, temperature variable from subnormal to 103° F, general debility marked.

May 26, 1904, under ether anæsthesia, and with the patient

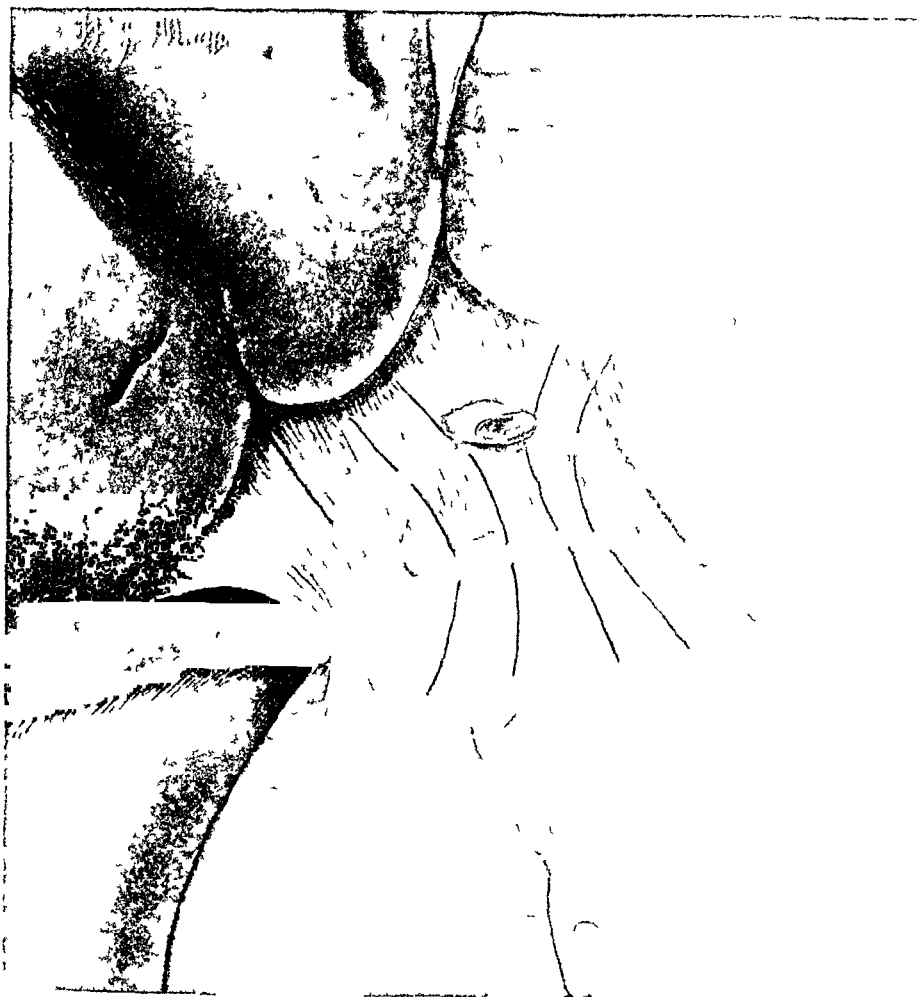


FIG 1—Liver raised upward End of hepatic duct freed and sutures placed ready to draw duodenum into position Note that gall bladder was removed at previous operation



in Robson position, a five-inch incision was made just internal to and parallel with the cicatrix of the former wound. A dense tangle of adhesions was encountered, involving transverse colon, duodenum, and stomach on the one side, and the liver and ducts on the other. By following the remains of the fistulous tract carefully and keeping close to the liver, the original drainage opening at the site of the cystic duct was discovered. The hepatic duct was dilated and easily admitted the tip of the index-finger to the primary division. The common duct was reduced by cicatricial contraction to a fibrous cord, along which could be traced a little stain of bile. During the separation of adhesions, it was noted that the duodenum overlapped the remains of the common duct and formed one wall of the fistulous tract in its deeper portion. The external incision was continued to the sternal notch and the overlying liver held upward. The duodenum was still further mobilized. The hepatic duct was freed from its attachment to the fistulous tract and from the remains of the common duct, the adhesions posteriorly were not otherwise disturbed, and served a very useful purpose. About three inches from the pylorus the duodenum was caught with three catgut sutures and fastened firmly to the adhesions and scar tissue about the hepatic duct, so that it was brought into contact with the end of the hepatic duct (Fig 1). At the point of easy contact an elliptical piece of all the coats of the duodenum was excised of about the same diameter as the open end of the hepatic duct (Fig 2), and four or five catgut sutures were introduced from the mucous side through all the coats of both duct and intestinal wall. In this way the posterior line of the anastomosis was completed. By alternately placing a suture externally and internally, the sides were built up in a similar manner to a two-row intestinal anastomosis, excepting that only the inner row penetrated the duct wall. At the upper part, the few remaining sutures were all placed before they were tied (Fig 3). The duodenum was still further attached laterally and anteriorly to the scar tissue, covering the liver and ducts by catgut sutures, making a broad area of attachment. A drain of rolled gutta-percha tissue was placed at the upper angle of the abdominal incision and another at the lower, but each at a considerable distance from the anastomotic suture line. The abdominal incision was then closed. Time of operation, fifty minutes. Patient made an uninterrupted recovery. There

was no leakage of any kind, drains were removed on the sixth day, patient discharged on the sixteenth day. Patient re-examined ten months after the operation (March 22, 1905), had gained thirty-one pounds in weight, and was in excellent health. I would here remark that the original removal of the gall-bladder was unfortunate, as a cholecystenterostomy would have been far easier as a second operation, provided, of course, that drainage would have restored its function to a sufficient extent. Since that time we have been more conservative about the removal of the gall-bladder in connection with common duct surgery.

# THE SURGICAL TREATMENT OF CHRONIC MUCOMEMBRANOUS AND ULCERATIVE COLITIS, WITH SPECIAL REFERENCE TO TECHNIQUE<sup>1</sup>

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COLITIS of its different types is not uncommon, clinically, they are at some stages so much alike that a proper classification has not been made. The classification that I desire to assume (W Hale White) may be summarized as follows

1 *Chronic Primary Colitis*—by primary is meant an inflammation *not* secondary to an injury or extension from neighboring parts or secondary to some constitutional disease, such as Bright's disease. 2 *Chronic Primary Membranous Colitis*—mucous colitis. 3 *Ulcerative Colitis*—dysenteric or not. All of these have long been described in our text-books and are well known, although disputes have arisen regarding their bacteriology. We have of late years learned of other forms of colitis, clinically very similar to the above, differing only in degree and in that they are *secondary*, and all are amenable to betterment or cure through surgical treatment.

The first operation for the relief of chronic colitis was performed by Mr Keith in 1894, the subject was a patient of Dr Simpson's, and the case was published in the *Medical Press and Circular*, July 29, 1896.

The second case was of W Hale White, of Guy's Hospital, operated by Mr Golding Bird, and reported in the *Clinical Society's Transactions*, vol xxix, 1895. Although these seem the earliest reported cases of rebellious colitis submitted to surgical treatment by right inguinal colotomy, yet I have been told that English surgeons in India were the first to per-

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<sup>1</sup> Read before the Chicago Surgical Society, March 6, 1905

form right inguinal colotomy for the purpose of giving rest to the colon, and that the patients they operated on were those suffering from the consequences of "Hill Diarrhoea" as well as from dysentery Halsted, of Baltimore, was probably one of the first American surgeons to do the operation, the patient was one of Osler's This author, in his "Practice of Medicine," 1902, says, regarding mucous and membranous colitis, "right inguinal colotomy has been performed with success in several cases of great obstinacy The artificial anus should remain open for some time" To date, the operation has been done many times all over the world It is rather queer to relate, however, that Boas, in his work on "Diseases of the Intestines," 1901, says, "Among the curiosities of treatment I may mention that the surgeons have attempted to cure membranous colitis by the establishment of an artificial anus They claim to have had successful cases" In 1904, according to K Vogel (*Munchener Med Woch*), Boas reports cures of ulcerative colitis by making an artificial anus in the cæcum and irrigating the colon in this way I refer to these questions of operative treatment at this time in order to draw attention to the fact of the rather sceptical views of recognized clinicians as to the value of surgery in the treatment of rebellious colitis up to within a very recent period

It is to John B Deaver, of Philadelphia, that we must give the credit for directing the attention of the profession to the fact that some cases of mucomembranous colitis were caused by disease of the vermiform appendix After reporting a typical case, he said ("Treatise on Appendicitis," 1896), "The removal of the diseased organ, which latter is probably the primary cause of these troubles, leading as it does to inadequate digestion in the large bowel, colitis, etc., or simply to malassimilation, auto-intoxication, and neurasthenia, is primarily only of utility in removing the constant danger to life by which these patients are threatened", Deaver then goes on to state that the benefits of operation are slow in their establishment Following Deaver, George E Shoemaker, of Philadelphia, published a paper in 1898 (*ANNALS OF SURGERY*,

1898), entitled "The Importance of Chronic Irritability of the Colon, with Mucous Stools as a Symptom of Appendicitis" This was an interesting communication and attracted wide attention It has remained, however, for Sir William Macewen to give a scientific explanation of some of the uses of the appendix, and how an interference with its function may react upon the colon, causing inflammatory changes, mucous colitis, etc Since Casper Bauhin discovered the ileocæcal valve in 1579, down to the present, little attention has been paid to it excepting some clinically important experiments, particularly those of Senn regarding its competence when fluids and gases were forced into the colon through the anus Within the past two or three years, physiologists, among them T R Elliott and Keith, have made exhaustive studies and experiments regarding the innervation of the ileocæcal valve It appears that "the junction of the large and small intestine is controlled by a muscular sphincter, not by a mechanical valve Stimulation of the sympathetic nerves causes the sphincter to contract, though at the same time inhibiting the circular muscle in the wall of the ileum and colon adjoining the sphincter" Elliott, in discussing this subject, draws attention to the fact that in many animals, as, for example, the bear, hedgehog, and ferret, there is no ileocolic sphincter to enable a distinction between the small and large intestine The human arrangement of an oblique entry of the ileum into the colon results in the formation of a valve, yet its fundamental control is by a muscular sphincter As an example of this sphincter, in the London Hospital Museum may be found a pathological specimen of "an ulcerated colon" which exhibits a "simple evaginated sphincter without any differentiation of valves or circumferential ledges"

Macewen, in a recent address delivered at the Charing Cross Hospital Medical School, narrates some very interesting observations and experiments that he was enabled to carry out in a case of a man whose cæcum had been opened and exposed, the result of an explosion Through this wound the surgeon could see the interior of the cæcum, the ileocæcal orifice, and



the mouth of the appendix, his opportunities were very similar to those of Beaumont in the St Martin case. To briefly summarize Macewen's observations, it was noted that when food was taken into the stomach the mucous secretion of the cæcum increased, and was much augmented just before chyme began to come through the ileocæcal orifice, at one observation quite a stream flowed from the appendix. The flow through the ileocæcal valve was not continuous, the chyme coming in small quantities at a time. The cæcal and appendix secretions were invariably alkaline, the chyme coming through the valve is acid. As Pawlow has shown that the "acid reflex" of the pylorus prevents too great a flow into the intestine, there being no alkaline reflex, thus Macewen reasons that an "alkaline reflex" in the cæcum controls the flow of the acid contents of the ileum through the ileocæcal valve, to the degree that normally the contents of the cæcum may remain neutral. Whenever this reflex was interfered with, the too rapid flow of acid chyme into the cæcum and out upon the skin caused great irritability of the latter, indicating how easily normal digestion in the cæcum could be interfered with and irritation developed. Mental shock and irritability were found to very materially lessen the secretions of the appendix and cæcum. Macewen says, "The nervous mechanism of the appendix is more in keeping with that of the small intestine than of the colon, it is supplied by the terminal branches of the same group of nerves as supply the small intestine, the superior mesenteric plexus of the sympathetic. Reflex action may be easily set agoing in the appendix by stimuli from the small intestine, and each part may react on the other. When it is recollected that the circular muscles of the cæcum are continuous with those of the appendix, and that the longitudinal cæcal bands end themselves on the appendix, it will be understood how easily the nervous apparatus of the appendix may irritate the larger movements of the cæcum by first inducing movements in the appendix, and how inhibition of these movements may cause cæcal disturbance. The same agency by control of the vascular supply will regu-

late the exudation from the appendix, and that in accordance with the impulse received from the small intestine”

Physiologists are beginning to recognize the necessarily important part that the appendix, cæcum, and ascending colon take in digestion. As early as 1813, Sir Everard Home noted that important digestion went on in the colon, but little notice has been taken of this subject. In fact, the fad of the day seems to be that the whole colon is simply a sewer canal. Acting on this theory, some surgeons have of late written in a rather depreciative way of its usefulness, and have advocated partial or complete excision rather than milder and more safe methods whenever these were possible. The glandular structure found in the appendix and colon prove beyond doubt the importance of these parts in digestion, and any abnormality of this function, whether as a cause or effect, will react. The micro-organisms always present in the appendix, cæcum, and colon, and assisting in the digestive process, may become pathogenic, and inflammatory changes result in the appendix itself or in the cæcum and colon. This interference may in the case of the appendix result in an inflammation mostly confined to that organ, an appendicitis, or else the abnormal secretion of the appendix, and perhaps cæcum also, may so interfere with the alkaline reflex of the ileocæcal sphincter that a too rapid escape of the acid chyme from this orifice into the cæcum and ascending colon will be followed by catarrhal inflammation of perhaps the entire colon. This is to me the only rational explanation of how a chronic appendicitis may bring about a mucous colitis.

Again, any abnormal position or angulation of the colon which would interfere with its digestive process may, and often does, result in some type of colitis. Downward displacements of the right kidney, dilatation of the cæcum or sigmoid resulting from adhesions or chronic constipation can and often do produce a mucous colitis, and in some rare cases ulcerative colitis and perforation.

The beautiful experiments of W. B. Cannon, of the Laboratory of Physiology, Harvard University (*American Jour-*

*nal of Physiology*, 1902), on the "Movements of the Intestines studied by Means of the Rontgen Rays," throw a bright light upon a hitherto little understood subject, viz, the mechanical process of digestion, and we can readily understand how, through the continuous interference with this mechanism, inflammation may result

Briefly, for the purposes of this paper, I will avail myself of some of the observations of Cannon. If bismuth subnitrate 10 to 33 per cent is mixed with the food, the movement of the intestinal contents, and thereby the movements of the intestinal walls, can be observed on the fluorescent screen

Although it would be interesting to study the movements of the food through the *small intestine* as observed in the experiments of Cannon, it must suffice now to state that *antiperistalsis* was not observed, and strong evidence was obtained going to show that the statements of Grutzner (*Deutsche med Woch*, 1894, xx, p 897) and others as to the occurrence of this phenomenon was yet to be proved

However, antiperistalsis was shown to be a constant factor in the digestive process in the large intestine. As the chyme enters the colon from the small bowel, it is carried by antiperistaltic waves into the cæcum, and all new food as it enters is likewise affected by these waves, and is, as Macewen has shown, mixed with the secretions of the glands of the appendix and cæcum. This chyme is not, as we have generally been taught, forced along slowly, but continuously towards the rectum. As the fluid in the cæcum travels upward it is forced backward by an antiperistaltic wave, and by a churning process becomes well mixed for the absorption of its more liquid and nourishing portions. As the contents of the large intestine move along they are met by other antiperistaltic waves. In fact, "the usual movement of the ascending and transverse colon and the cæcum is an antiperistalsis. This antiperistalsis gives a new significance to the ileocæcal valve," which by its competency prevents a back flow into the small bowel and admits of thorough mixing and absorption. As the

left portion of the transverse and descending colon are reached by their contents, peristalsis forces this onward, until by peristalsis and the pressure of the abdominal muscles evacuation occurs. One of the most interesting and, to me, important observations made by means of the X-rays was the disposition of nutrient enemata. We, at least I, have always thought that these were absorbed in the rectum and lower sigmoid, but careful observations with small and large enemata, thick and thin enemata, all of which contained bismuth, have proven that this is not the case. When small nutrient enemata are introduced, after lying in the descending colon, they are taken hold of by antiperistaltic waves, which carry them to the cæcum. The observer noted that "when large amounts are injected they stop for a moment in the region between the transverse and descending colon as if a constriction existed there. Then a considerable amount of the fluid passes the point and antiperistaltic waves carry it to the cæcum."

Absorption takes place as the waves pass, and the gradual increasing dimness of the bismuth shadows is observed, except in the descending colon, here they retain the original intensity. This proves that most absorption takes place, *i e.*, of the liquid, above the descending colon. When the enemata were large and thin, about the consistence of cream, leakage occurred through the ileocæcal valve and the fluid passed into the small intestine. I have outlined the digestive process in the cæcum and colon in order, first, to direct attention to the manner of production of disturbances in the functions of the appendix and cæcum which may lead to a colitis, second, that we may readily comprehend how mechanical interference with both the peristalsis and antiperistalsis of the colon can result in some one of the forms of colitis. Edebohl's first insisted upon the relationship between displacement of the right kidney to catarrhal appendicitis, but I believe that the recent article by P. Alyaie, in the December number, 1904, of the *Revue de Chirurgie*, is of value in the same direction. In it he points out from post-mortem studies how by a descent of the right kidney the hepatic flexure is pushed down, the ligament

of Toldt binding the lower pole of the kidney and the flexure of the colon strongly together. The result being a marked angle, and in some cases narrowing in the colon at the junction of the ascending and transverse portions. Interference with the digestive functions in the cæcum and ascending colon resulting.

A few days ago, during an operation, I had an opportunity to verify this finding, a mucous colitis had developed as a consequence of the condition. It was noted, also, that the long axis of the kidney was directed downward, inward, and forward when normally the direction is downward, outward, and backward. Adhesions had formed which would not admit, even after replacement of the kidney, of the natural restoration of the position of the colon.

Lane (*Lancet*, November, 1904) has recently directed attention to the stagnation in the colon resulting from angulation following adhesions, and the cure of the disturbed colonic function by surgical methods. In order to cope successfully with the different kinds of colitis, we must in so far as possible be able to differentiate the cases and apply the surgical procedure to fit the cause. This is rather new surgery, but has a field of usefulness. Any form of colitis which had resisted careful medical treatment must be studied with a view of determining the cause and the reasons for the persistence of the cause. We may for surgical convenience recognize three kinds of colitis. First, the inflammatory due to the effect of some specific organism, an inflammatory disease commencing in, and mostly confined to, the colon. Second, an inflammatory condition secondary to an inflammation or derangement of function of the vermiform appendix. Third, an inflammation induced by mechanical interference with the peristaltic, and more especially the antiperistaltic, waves of the colon.

The surgical treatment of colitis, if carried out in recognition of these causes, will be successful. And to be successful, the type of operation must be selected with a view to meeting the pathology. It will not do nowadays to confine ourselves

in all cases to a right inguinal colotomy This may have done for the class of cases for which it was first selected, but even in this class, which I will designate the bacteriological, the artificial valvular fistula operation suggested by Gibson, of New York, has many advantages Not the last being the annoyance of a large open fistula and the inevitable loss of weight and strength which always follows the free external discharge of chyme as it comes direct from the ileocæcal orifice In my experience with the appendicular forms of colitis, there are two varieties, first, and most common, the *explosive form*, which is recognized in its commencement, *i e*, the first few hours, by intense general abdominal pain with tenderness over the appendix In from six to twenty-four hours dysenteric symptoms develop which may last some days, and then gradually subside or persist with moderate symptoms for several weeks These attacks recur The other form is of the kind described by Deaver and mentioned in the first part of my paper

In the first kind the removal of the appendix is all that is required, as has been so in three of my cases In the neurasthenic type of Deaver not only should the appendix be removed, but the Gibson cæcal fistula ought to be established, the long-continued interference with cæcal and colonic digestion by the abnormally functioning appendix has brought about changes in the mucosa of the colon that can only be cured by the rest and local treatment afforded through this fistula If these simple means will not bring about a cessation of the discharges and the impaired health which always accompanies them, then something further must be done The colon must, in greater or less part, be excluded from the process of intestinal digestion and the function established gradually by the small intestine and the remaining portion of the colon Operations for exclusion have undergone a remarkable evolution

Formerly, we had the old operation of Maisonneuve, which is all sufficient in the treatment of many cases of mucous colitis But this anastomosis opening may close as in one of

my cases, just as the same thing happens after a gastro-jejunostomy when the pylorus is freely patent. Taking advantage of the experimental work of Dr N Senn ("Intestinal Surgery," 1888), surgeons divided the ileum close to the ileo-cæcal valve, sutured the distal end, and implanted the upper end into the sigmoid flexure or upper rectum. This usually gives practically complete rest to the colon and the colitis is cured. In some cases, however, by the process of antiperistalsis or retroperistalsis, the intestinal flow is directed backward until it reaches the cæcum and irritation develops.

Although this has not happened in three cases in which I have carried out the technique, perhaps not in two of them because I did the Gibson operation at the same time, yet it has happened, and Monprofit has shown us how to prevent the occurrence. He does what he is pleased to call "Exclusion with Drainage into the Intestine." There seems to be a rather indefinite idea of what "intestinal exclusion" really means. Elsewhere (*Medical Herald*, June, 1904) I have discussed the subject.

As M H Hartman (Paris) says, "the term exclusion of the intestine ought to be reserved to operations in which the continuity of the intestines is interrupted by one or two sections. The exclusion or sequestration of the intestine can be either *unilateral* or *bilateral*, and is known as the operation of Saltzer."

In *exclusion unilateral* the intestine is divided above the portion which we wish to exclude, the superior end is anastomosed or implanted into a portion of the bowel below the portion which we wish to exclude. The divided end of the section excluded is either closed or perhaps fistulized to the skin.

In *exclusion bilateral*, two divisions of the intestine are made, one above, the other below, the part excluded, the divided ends peripheral and central are anastomosed. The divided ends of the excluded portion can be closed or fistulized to the skin, or, better, they can be closed and a valvular fistula made at some suitable point in the section. In cancer,

entero-anastomosis suffices to bring about a cessation of accidents. In cases where it is indicated, exclusion is inferior to operations which definitely and immediately suppress the lesion (resection of the intestine, liberation and suture of the fistula, etc.)

Doyen and Monprofit say that if both ends of a section of the bowel be occluded, the procedure can chiefly be considered in the light of a physiological study of the secretions of the excluded bowel, but clinical experience proves that in a certain number of cases, although no fistula of the excluded section be made, nature by a process of obliteration, because of lack of function, so takes care of the excluded portion that atrophy and obliteration follow without detriment. When fistulization is employed, the fistula sometimes persists for an indefinite period. The mortality after complete exclusion without drainage, *i e*, the suturing together of both ends of the excluded section, or the separate suturing of each end, is greater than when the excluded part is fistulized.

According to Mikulicz, Herman, Saltzer, and others (*Handbuch der Praktischen Chirurgie*, Band III) who have made experiments on animals, and Boracz Von Eiselsberg, Narath, and others who have studied the subject in the human being, a section of the healthy intestine can be excluded with both ends closed without drainage and the procedure be followed by little danger. When, however, the excluded section is diseased, the secretion is increased, especially in ulcerated conditions, while the absorptive powers are diminished, this can lead to over-distention and rupture. In the sound intestine secretion and absorption are about equal, and the mucous membrane finally becomes atrophied. Therefore, unless a fistula is already in existence, Mikulicz and Kausch insist that when exclusion is made, the excluded section must be fistulized with the skin, in such conditions I would suggest the artificial valvular fistula after the method of Gibson. However, in order to overcome consequences, imminent or remote, regarding the accumulation of secretions or the persistence of fistulization in the excluded section, a surgical procedure is available.



Monprofit (*Chirurgie du Gros Intestine*) has very recently brought forward an ideal technique which he designates "exclusion with drainage into the intestine" in contradistinction to exclusion with skin fistulization. It is applicable to all possible cases, and it may be used in affections of the large intestine, the jejunum, the ileum, or even of the duodenum. It is the application of the gastro-enterostomy by double implantation, "en Y," as it is called.

In order to make the method clear, let us take a case of obstruction of the bowels due to a tumor of the ascending colon. If the ileum be divided near the cæcum, but sufficiently far away, about 20 centimetres suffice, so that the cut ends can be implanted, the lower into the sigmoid flexure of the colon, the upper into either the transverse or descending colon, the intestinal current is re-established, and the diseased excluded ascending colon is drained into the sigmoid flexure.

The theoretical objection that fluids from the excluded part of the colon would not drain through the ileocæcal valve into the stump of the ileum on into the sigmoid flexure does not hold in practice.

The pathology in the colon brings about changes in the valve which result in incompetency. Monprofit discusses the advisability of shutting off the valve by dividing the ileum close to the cæcum, suturing the valve end and then implanting the other end into the cæcum or colon near the original ileocolonic juncture. In practice, this seems unnecessary, especially at the primary operation, and calls for too much time in addition to that required for the absolutely essential procedures. Obstructions in the colon other than those very low down in the sigmoid flexure can all be treated by intestinal exclusion with drainage, likewise obstructions of the small intestine. In suitable cases, that part of the bowel obstructed can be excised, either primarily or as a secondary operation. In a case of my own, this method of exclusion with drainage into the intestine has been followed by the happiest results.

It would seem an improvement over this method of Monprofit's, if, instead of dividing the lower ileum, it be approxi-

mated to the sigmoid and two anastomosis openings made, between these openings the ileum should be occluded by a purse-string suture, and both limbs fastened to the sigmoid so as to close any opening that might permit of a loop of intestine becoming strangulated. My personal experience in the surgical treatment of mucous membranous and ulcerative colitis is limited to eight cases, exclusive of mild catarrhs of the cæcum and appendix due to displacement of the right kidney. Four have had the Gibson operation, and two of these had in addition the ileum divided. The lower segment occluded and the upper implanted into the sigmoid. One of my operations was that after the technique of Maisonneuve. In another an ulcer of the sigmoid was excised. In one case the urgency of operation was determined by an intussusception of the lower ileum, probably resulting from the antiperistalsis in the colon.

I have had one death due entirely to too long delay and to too much zeal upon my part to correct some serious pelvic complications. The eight cases referred to were operated in the Clarkson Hospital, Omaha.

# THE TREATMENT OF CONGENITAL AND ACQUIRED LUXATIONS AT THE SHOULDER IN CHILDHOOD<sup>1</sup>

BY ROYAL WHITMAN, M D,

OF NEW YORK,

Associate Surgeon to the Hospital for Ruptured and Crippled

It is of interest to note that while congenital dislocation at the hip, a misplacement present before birth, is relatively common, congenital dislocation at the shoulder in this sense is very uncommon

In the great majority of cases, it is an acquired rather than a prenatal disability, that perhaps might be better described as a deformity of the arm than a dislocation of the humerus

This group of cases may be divided into three classes

- 1 True congenital misplacement of the humerus
- 2 Dislocation caused directly by violence at birth
- 3 Acquired subluxation, due to injury of the brachial plexus

Cases of the first class are very uncommon, and are therefore relatively of little importance

Cases in the second class are relatively uncommon also. The dislocation in these cases is apparently caused by traction on the arm at delivery, or by swinging the child by the arms in attempts at resuscitation. In most instances there is injury to the brachial plexus as well.

In the third, and numerically by far the most important class, there is no primary displacement, and the subluxation found in later years can be classed as congenital only in the sense that it is induced by injury at birth.

The sequence is somewhat as follows. In cases of obstetrical paralysis, the injury to the brachial plexus caused by trac-

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<sup>1</sup> Read before the New York Surgical Society, March 8, 1905

tion, and pressure on the neck, ordinarily involves the fifth and sixth roots. The characteristic paralysis therefore is of the deltoid, the biceps, and the supinators of the forearm, thus the arm hangs by the side in an attitude of inward rotation and pronation. During the period of repair, extending over several months, and which is often incomplete, accommodative retraction and contraction of the tissues take place that prevent resumption of normal attitudes when recovery is complete, and which favor greater disability if the injury to the nerves is irremediable.

In cases of obstetrical paralysis seen soon after birth, it may be noted that the tissues at the seat of the injury are often sensitive to pressure, there may be swelling at the shoulder, and passive motion of the arm causes evident discomfort. These symptoms of direct injury gradually subside, but if, meantime, the arm has been allowed to hang by the side unsupported, a very decided resistance is apparent when one attempts to rotate the humerus outward or to abduct it, even during the early months of infancy.

There is a very general impression that spontaneous recovery is the rule after obstetrical paralysis, consequently, systematic treatment for the purpose of preventing deformity is not usually employed, and, although the original helplessness gradually lessens, the comparative disability may become more marked with development.

In a characteristic case of this type, the habitual pronation of the hand and the awkwardness of the arm are very noticeable. Usually, the extremity is smaller and shorter than its fellow. The humerus is somewhat abducted on the scapula, its upper extremity projects behind and below its normal position, and there is a corresponding flattening of the tissues on the front of the joint. The deltoid is usually completely atrophied, and there is practically ankylosis at the articulation. In many instances the power of flexion of the forearm has been regained, and that of the supinators also, but this cannot be properly exercised because of the restriction of motion at the shoulder.

In these cases the deformity and disability of the arm are much more noticeable than the displacement of the humerus, but this displacement and the other restrictions to normal motion that accompany it, although secondary to the paralysis, have become of greater importance than the original lesion, since they prevent functional use, and are thus in great degree accountable for the loss of growth and the comparative uselessness of the extremity

If the displacement of the humerus is complete, or more extreme than might be accounted for by development in the attitude of deformity, one may conclude that the dislocation and the paralysis were each the direct effect of injury at birth. In such cases the prognosis is of course much more favorable than in the preceding class. Finally, if an actual dislocation is present without history of injury or of paralysis, it may be classed as truly congenital.

In all cases of this character of whatever class, the first indication is to reduce the deformity. In cases of the third class, which, as has been stated, are by far the most common, the ultimate purpose of treatment is to overcome the inward rotation of the humerus so that the power of supination of the forearm may be utilized. In this, as in all other disabilities secondary to paralysis, the actual degree of irremediable injury to the nervous apparatus cannot be estimated until deformity and restriction of motion have been overcome. In many instances, partial, or even complete, recovery from the original paralysis may have taken place, and yet there has been no return of function because of the restraint exercised by secondary contractions and adhesions. Thus, in certain cases of this character, practical functional cure may be attained when these obstacles are removed. I mention this point particularly, in order that it may not be assumed that I regard correction of deformity as a treatment of paralysis other than in the manner indicated.

It was at one time generally believed that a large proportion of these cases were truly congenital, and that there were accompanying developmental defects that would prevent repo-

sition Thus the treatment originally advocated by Phelps was to open the joint on the posterior aspect, and to cut away sufficient of the head of the humerus to accommodate it to the contracted capsule It seems more rational, however, from the point of view that I have indicated, to increase the capacity of the joint rather than further diminish the size of the already atrophied head of the humerus Afterwards, one must assure the improved position by fixing the parts for a sufficient time to permit readjustment of the tissues In other words, the treatment should be similar to that of bloodless reduction at the hip-joint

The child, having been anæsthetized, is brought to the edge of the table The shoulder is grasped firmly with one hand in order to restrain the movements of the scapula, and with the other the arm is drawn upward and backward over the fulcrum of the thumb, which lies behind the joint Thus, the so-called pump-handle movement, alternately relaxing and stretching the contracted parts, is carried out over and over again with slowly increasing force, the aim being to force the head of the bone forward, and thus to overcome the resistance of the anterior part of the capsule When this has been accomplished, there is a distinct depression behind, and the head of the humerus projects in front, at a point below its proper position

One then attempts to overcome the abduction and to force the head upward by changing the grasp on the scapula and using the thumb in the axilla as a fulcrum When the arm can be carried across the chest to the normal degree of adduction, the final, and often most difficult, part of the process, namely, to stretch the tissues sufficiently to permit the proper degree of outward rotation, is undertaken This is best accomplished by flexing the forearm and using this to exert leverage on the humerus, care being taken, of course, to avoid the danger of fracture When the head of the bone has been replaced, it will often be noted that the tension on the anterior tissues causes flexion of the forearm, this must be overcome in the same manner, and, finally, the limitation to complete supina-

tion The extremity is then fixed in the over-corrected attitude by means of a plaster bandage which includes the thorax That is, the arm is drawn backward so that the head of the humerus is made prominent anteriorly, the forearm is flexed and turned outward to the frontal plane, while the hand is placed in extreme supination, the arm lying against the thoracic wall

In the more extreme cases it is impracticable to complete the operation at one sitting When, therefore, as much force has been exercised as seems wise, a plaster bandage is applied, and after an interval of two weeks the further correction is undertaken

As has been stated, when the head of the bone is forced forward, a distinct depression and evident relaxation of the tissues is noted on the posterior aspect of the joint The object of the fixation is to allow the contraction of the posterior wall of the capsule and the obliteration of the old articulation, consequently, the part must be fixed for a period of at least three months When the plaster bandage is removed, the after-treatment is of great importance This consists of daily passive forcible movements to the extreme limits in the directions formerly restricted, namely, outward rotation, backward extension, and eventually abduction of the humerus and supination and extension of the forearm For in all these cases there is a strong tendency to a return in some degree to the original posture When motion has become fairly free, the disabled member must be regularly exercised and re-educated in functional use Under this treatment the weakened and almost completely atrophied muscles usually gain surprisingly in power and ability, and the longer it is continued the better will be the final result If the deltoid muscle is completely paralyzed, one cannot expect independent movement at the shoulder, and the aim should be to gain fibrous ankylosis in the attitude of outward rotation in order to permit supination of the forearm

To recapitulate The essentials of successful treatment of this difficult class of cases are complete overcorrection at



FIG 1 —The characteristic attitude of obstetrical paralysis, an attitude that causes deformity





FIG 2 —Subluxation of the humerus, showing the prominence of the head behind and below its normal position, and its effect upon its attitude, particularly in causing persistent supination



FIG 3—The same patient eight months after treatment, showing the range of abduction and the gain in muscular development



FIG 4 —A case similar to that shown in Fig 2 illustrating the improvement induced by exercise in a period of about eighteen months after operation

the time of operation, fixation for a sufficient time to assure the stability of the new articulation by accommodative changes within and without the joint, and the persistent after-treatment, as has been described

Although this paper is concerned primarily with displacements at the shoulder, there are other points of interest that may be mentioned briefly. For example, it is evident that this, in many instances, is one of the unnecessary deformities that might be prevented by support and by methodical passive motion of the arm during the stage of primary paralysis caused by injury at birth, or by the immediate replacement of a dislocation induced by violence at that time. It is evident, also, that this treatment should always precede the operation of nerve grafting, or other operation on the brachial plexus, for even complete restoration of the nerve supply would be of little use if function were restrained by deformity.

Finally, attention may be called to the fact that there is another class of cases in which the injury to the brachial plexus has been more severe, and in which the resulting paralysis is wide-spread. There is, as a rule, no displacement or other deformity at the shoulder, the appearance being one of helplessness rather than of contraction. In such cases other operations, such as tendon transplantation and arthrodesis, if supplemented by support, may make the useless member serviceable.

# TRANSACTIONS

OF THE

## NEW YORK SURGICAL SOCIETY

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*Stated Meeting, March 8, 1905*

The President, HOWARD LILIENTHAL, M D, in the Chair

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### PYLORECTOMY FOR CARCINOMA

DR CHARLES L GIBSON presented a man, fifty-three years old, who entered St Luke's Hospital on November 28, 1904. For a number of years past he had suffered from gastric and intestinal disturbance, but his serious trouble began about a year ago. He then first complained of severe gastric pain, increased by taking food, he had frequent attacks of vomiting, and he lost flesh and strength.

An examination failed to reveal any physical signs. There was no tumor in the region of the stomach. On examination of the stomach contents, free hydrochloric acid was present, and the result rather militated against the diagnosis of carcinoma. In spite of this, an exploratory laparotomy was decided on, and a good sized tumor involving the pylorus and lesser curvature of the stomach was found. A wide resection was done by the usual method, embracing practically one-half of the stomach, and the operation was completed by doing a posterior gastro-enterostomy.

The patient's convalescence was fairly uneventful. His temperature never went above 101° F, and he left for his home on the twenty-seventh day after the operation. His weight had increased from 116 to 145 pounds, which was the most he had ever weighed in his life. The pathological examination of the tumor proved it to be a carcinoma.

Dr Gibson said he had showed this case to particularly emphasize the fact that in some instances of this kind an operation should be undertaken more or less tentatively, without waiting for the classical signs of carcinoma

DR F KAMMERER said that in operating on cases of tumor of the stomach, it was frequently a difficult matter to decide whether to remove the pylorus or not. He recalled three cases in which the tumor at the pylorus was evidently benign, although presenting the gross appearance of cancerous growths, and was not removed. In one of these the speaker said he had occasion to reopen the abdomen seven weeks after the primary operation, and he then found that the tumor had entirely disappeared. The question that had to be decided in dealing with these cases was whether to do a resection or a simple gastro-enterostomy, or some other plastic operation on the pylorus. Pylorectomy was certainly a much more severe operation than either the Finney operation or a gastro-enterostomy.

Dr Kammerer said that the absence of free hydrochloric acid in the stomach contents could not always be relied upon, and he agreed with Dr Gibson that an operation was advisable, even in doubtful cases. During the past few months he had operated on five cases of benign tumor of the pylorus. In some of those cases the symptoms were indefinite, pointing to a chronic ulcer of the stomach, with pyloric stenosis. In all of them very marked changes at the pylorus were found.

DR HOWARD LILIENTHAL emphasized the importance of thorough and repeated examination of the stomach contents in doubtful cases. At least half a dozen examinations should be made, and these would oftentimes show surprising variations in the percentage of free hydrochloric acid, ranging from a normal quantity to its entire absence. Dr Lilienthal thought that all doubtful cases of tumor of the stomach should be looked upon as malignant, and treated accordingly. A palliative operation done in a malignant case was a calamity if a radical operation could possibly have been done instead.

DR GIBSON, in closing, said the surgeon was often led astray by the report of the examination of the stomach contents, and he suggested that improvement along that line of clinical investigation would be of great benefit in the diagnosis of obscure gastric lesions.

## TUBERCULOSIS OF THE OLECRANON BURSA

DR GIBSON presented a woman, forty-three years old, who noticed a lump in the region of the olecranon fossa of the left arm about four years ago. There was no history of traumatism. The mass gradually became larger, until it extended half-way down the forearm. Upon incision, it proved to be a tuberculous process of the superficial bursa of the olecranon. It was removed without difficulty, and the patient made an uneventful recovery.

## TUBERCULOSIS OF THE BREAST

DR GIBSON also showed a tubercular tumor of the breast which was removed under the supposition that it was an adenofibroma.

## SUBDIAPHRAGMATIC ABSCESS

DR JOHN A. HARTWELL presented a woman, forty-eight years old, married, who was admitted to the Lincoln Hospital on May 19, 1903, with the history that for seven months prior to her admission she had suffered from pain in the right hypochondrium and the anterior lumbar region. Nothing more definite regarding her previous history could be elicited.

Examination showed a rather poorly nourished woman, who apparently had undergone a good deal of suffering. The thoracic viscera were normal. Abdominal examination revealed considerable tenderness in the right hypochondriac and lumbar regions, and a movable tumor just above the iliac spine which gave the characteristics of a movable kidney. The appendicular region was also tender. The patient's temperature ranged between 100° and 102.5° F, the pulse between 100 and 120, and the respirations between 24 and 28. The pain persisted, with varying severity.

May 21, 1903, an exploratory incision was made through the middle of the right rectus, because neither the movable kidney nor the appendix seemed to account for the symptoms present. The movable tumor proved to be a kidney. There were many adhesions in the neighborhood of the gall-bladder and the transverse fissure of the liver, and a lesser number around the appendix. There were no indications, however, of a cholecystitis or an abscess in this region. The adhesions were broken up, and

the structures about the subhepatic region were freed. The appendix was then removed, and the laparotomy wound closed. The movable kidney was then anchored through a posterior incision, after the technique advocated by Edebohls. Pathologically, the appendix showed a mild grade of chronic inflammation of the mucous membrane.

The patient's symptoms were entirely relieved during the first five days following the operation, the temperature and pulse having both fallen to normal and remained so.

On the fifth day the patient's temperature again rose to 100.5° F, and this was repeated during the following two weeks, at intervals of twenty-four or forty-eight hours. In the meantime, both wounds had healed primarily. On the tenth day the temperature reached 102° F, and there developed râles over the lower right chest. The patient was gradually losing flesh and strength. A diagnosis of tuberculosis, probably pulmonary, was made, and on the twenty-sixth day after the operation she returned to her home in rather poorer condition than she was at the time of her admission.

During the three weeks that she remained at home, her irregular fever persisted, and the emaciation progressed. There was also present more or less constant pain, similar to that complained of prior to the operation. Her attending physician, Dr. Francis A. Auleta, examined her from time to time, and finally, on July 1, found signs of fluid in the right posterior chest, low down, and an exploratory puncture through the ninth intercostal space in the posterior axillary line withdrew pus.

The patient was readmitted to the hospital on July 2, 1903, and operated on the same day. An incision was made over the ninth rib, just anterior to the angle of the scapula. About an inch and a half of the rib were resected, exposing the pleura. The pleural cavity was closed by stitching the two layers together with catgut, with gauze packed around it. An incision was then made through the two pleural layers and the diaphragm, exposing the postero-superior border of the liver. The œdema and fibrous exudate in this region indicated the near presence of pus, and, by palpating the liver, fluctuation was obtained. An incision was made into the presenting surface of the liver, and a blunt instrument inserted, which resulted in a flow of thin, grayish pus. This opening was then enlarged, and almost a quart of pus evacu-



ated The site of the abscess was not definitely determined, but it seemed to be under the liver rather than in it, the puncture apparently passing through the organ near its posterior border

The kidney that had been operated on could be palpated through the wound, and was firmly fixed in the position in which it had been anchored

The wound was packed and drained Recovery was prompt and uninterrupted, the cavity filling entirely in about five weeks, when the patient was discharged Since then she had remained in excellent health The pleura did not become infected at any time The case was interesting because of the unexplained cause of the abscess, and because of the apparent improvement after the first operation, which failed to locate the trouble

#### CHOLECYSTECTOMY FOR GALL-STONES

DR HARTWELL presented a woman, twenty-six years old, who was admitted to the Lincoln Hospital on May 10, 1904, suffering from cholelithiasis, with the following history With the exception of a mild attack of what may have been biliary colic five years ago, she had always enjoyed excellent health She had never had any acute sickness, and her menstrual and maternal life had been absolutely normal, having had one child and no miscarriages Her digestion and nutrition had always been good

Five weeks prior to admission, she was suddenly seized with intense epigastric pain, which subsequently extended over the right hypochondrium Violent vomiting, sweating, and marked prostration accompanied the pain The latter she described as being a "tearing or crushing pain" over the lower costal arches There was no change in the color or character of the stools or urine The attack continued two days, and could only be controlled by anodynes No jaundice appeared then or later From that day to the time of her admission she had never been free from pain in the right hypochondrium, and the acute attacks occurred at frequent intervals, from a few hours to two days There was no relation between the taking of food and the attacks of pain Sometimes the latter would radiate to the right shoulder No calculi were ever seen in the stools Since the onset of her attack she had lost about twenty pounds

On admission, the following notes were made regarding her physical condition. There was marked adiposity, no jaundice, the thoracic viscera were normal, the abdomen showed distinct tenderness and rigidity over the region of the gall-bladder for an area about four inches in diameter. On account of the abundance of fat in the abdominal wall, no distinct tumor could be felt. The patient's temperature was  $102^{\circ}$  F, pulse, 120. The leucocyte count was 15,000. The urine had a specific gravity of 1030, it was acid in reaction, amber in color, contained a cloud of albumen and granular and hyaline casts.

Operation, May 11, 1904. The gall-bladder was found much distended, adherent, and thickened. In breaking the adhesions the bladder ruptured, and an enormous number of sand calculi, with purulent bile, were discharged into the wound. The largest was the size of a buck-shot, and the smallest less than the size of a pin-head. The ducts, on palpation, showed no stones present. The cystic duct was not ligated because it tore away from the suture and was not again found. The gall-bladder, after its removal, was widely opened, and a count showed something over 1200 calculi present, with an estimated total of about 1500. The largest was the size of a small pea.

The patient's convalescence was uninterrupted, the sinus closing in about six weeks, the free flow of bile during the first two weeks demonstrating the patency of the cystic duct.

DR LILIENTHAL said that in dealing with very large gall-bladders, he thought it safer, as a matter of technique, to empty them before extirpating them. By following this method, one would be less apt to cause rupture. As to the tearing out of a suture, the speaker said he had never seen it happen when it was passed through the walls of the cystic duct. In Dr Hartwell's case, the duct was apparently exceptionally tender.

In reply to a question, Dr Lilienthal said he did not consider it particularly dangerous to have the gall-bladder rupture during an operation, still, he preferred to avoid that accident, if possible. The speaker said he could easily conceive of a case in which stones of considerable size might happen to be lost in the abdominal cavity and decidedly interfere with the healing process.

## RESECTION OF STOMACH FOR CARCINOMA

DR WILLY MEYER presented a specimen obtained from a woman, forty-eight years old, who was admitted to the German Hospital early in November, 1904. For two months previous to that time her health had been gradually declining. An examination showed that the stomach was evidently much enlarged, and, after more than thirty minutes' lavage, particles of food taken several days before were still ejected. A distinctly movable tumor could be made out, lying principally to the right of the xiphoid cartilage.

The abdomen was opened on November 10, 1904, and a tumor was found involving the pylorus and at least half of the upper portion of the duodenum, and projecting into the lumen of the stomach. There were many enlarged glands below the greater curvature. The stomach was divided between two Kocher clamps, and the cut borders wiped with lysol solution. The portion of the stomach to be resected was surrounded with gauze, and turned towards the right side of the patient. The cardiac portion of the stomach was now closed in the usual way. A small duodenal clamp was then applied at the distal end of the tumor, and an intestinal compression clamp next to it, as low as possible. The latter clamp having been removed, the gut was surrounded with a silk ligature and divided above it, and its cut end provided with a purse-string suture. Before this was tied, the assistant accidentally withdrew the silk ligature from the gut, allowing some of the duodenal contents to escape. After thoroughly cleansing the wound, the cut surfaces of the gut were inverted and closed by two rows of interrupted silk. The head of the pancreas was conveniently near, and, following his usual custom in these cases, Dr Meyer made use of it by stitching it over the line of suture. A posterior gastro-enterostomy was then done with Murphy's button, and, on account of the protruding mucous membrane, three additional interrupted silk sutures were inserted. After these had been placed, as the gut seemed to be kinked a good deal at the point of anastomosis, the efferent part was stitched to the stomach wall with a few sutures. Finally, the omentum was turned up and stitched over the pancreas and the divided duodenum. With the exception of some symptoms pointing to intestinal obstruction, which were relieved

by the passage of the button on the eighteenth day, the patient made an uneventful recovery. At present she is in perfect health.

#### SACCULATED POPLITEAL ANEURISM, MATAS'S OPERATION

DR WILLY MEYER reported a case of Matas's operation for popliteal aneurism, with remarks upon the procedure

#### BILATERAL CERVICAL RIB, CONGENITAL TORTICOLLIS, SPINAL CURVATURE AND MENINGOCELE

DR ROYAL WHITMAN presented a boy, ten years of age, with a cervical rib on each side, associated with extreme congenital torticollis, spinal curvature, and a meningocele on the back of the head. The torticollis had been improved by a division of the muscles a year ago, and, although a facial atrophy was extreme, the improvement was marked. The most significant sign of cervical ribs was broadening of the base of the neck and the abnormal resistance to labial pressure in this region.

#### DISLOCATION OF THE SHOULDER-JOINT

DR WHITMAN presented a girl, eight years old, who probably, as the result of injury at birth, sustained a dislocation at the right shoulder, with accompanying obstetrical paralysis. When Dr Whitman first saw her last August, the arm was turned inward, the forearm was pronated, and function was very poor. The luxation of the humerus was reduced, and the child now has good use of the arm. With proper and regular exercises, Dr Whitman said, perfect function of the limb should be restored.

#### THE TREATMENT OF CONGENITAL AND ACQUIRED LUXATIONS AT THE SHOULDER IN CHILDHOOD

DR ROYAL WHITMAN read a paper with the above title, for which see page 110.

# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting, March 6, 1905*

The President, HENRY R WHARTON, M D, in the Chair

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### THE MATAS OPERATION FOR THE CURE OF ANEURISM

DR JOHN H GIBBON presented a negro man, thirty-one years of age, whom he had subjected to the Matas operation for the cure of a popliteal aneurism. He stated that he believed this operation was as great an advance over the older ones as that of the Bassini operation for hernia is over its predecessors. The operation of Matas had been recently and completely described by the author in the ANNALS OF SURGERY for February, 1903. The possibility of performing this operation was suggested to Matas by the fact that the lining membrane of the aneurismal sac is the same as that of the vessel itself, and by the good results which have been obtained where arterorrhaphy has been practised.

In the case of sacciform aneurism where the sac is evacuated and the opening into the artery sutured without interference with the circulation, there can be no comparison between this operation and ligation. And even in fusiform aneurisms the advantages of this new method over the older one of ligation are paramount. Dr Gibbon knew of no instance where the suggestion of Matas that it might be possible to reconstruct the artery by utilizing a portion of the sac in fusiform aneurisms had been done, but the method certainly seems worthy of trial. One of the greatest advantages in closing the arterial openings within the sac of an aneurism is the fact that the collateral circulation is not interfered with in the least possible way.

The Matas operation is applicable to all aneurisms in which there is a distinct sac, and in which the cardiac end of the main vessel can be thoroughly controlled.

The case reported by Dr Gibbon was admitted to the Pennsylvania Hospital on October 27, 1904. At the time of his admission the aneurism was about the size of two fists, and could easily be seen projecting beyond the normal line of the leg on each side. The leg and foot were so enormously swollen as to resemble a marked elephantiasis. The patient said that he had been struck on the back of the leg eight or nine months previous, and he attributed the development of the aneurism to this injury, he denied syphilitic infection. A positive diagnosis of aneurism of the popliteal artery was made without difficulty, as all the typical signs were present. After two days' rest in bed the œdema of the leg greatly decreased, but no pulsation was ever detected in either the anterior or posterior tibials. Two days after admission, after elevation of the leg and the application of an Es-march constrictor well up on the thigh, a long incision in the middle of the popliteal space over the aneurism was made. The sac was laid freely open from end to end and a quantity of liquid blood and clot in various stages of organization was evacuated. At the upper and lower part of the sac could be demonstrated the opening of the vessel. Dr Gibbon thought for awhile that it was a saciform aneurism, as he could not find the point of exit of the artery, but finally he was able to do so near the upper part of the lower end of the sac, in other words, the sac had developed posteriorly and extended under the inner head of the gastrocnemius. It was impossible, because of the shape of the sac, to re-establish the caliber of the vessel, and Dr Gibbon therefore followed Matas's plan of closing the openings of the artery with a small chromicized suture carried on an ordinary curved intestinal needle. No openings of collateral vessels in the sac were found, and therefore the constrictor was loosened, as there was no bleeding even after this was done, he thoroughly cleansed the sac, rubbing its interior with weak bichloride solution followed with salt solution. The sac was then entirely obliterated with repeated rows of chromicized gut sutures. There was considerable oozing from the cut edges of the sac, but this was controlled by a whipstitch. The skin was closed entirely and a dressing applied. The patient did well after the operation, but on the second day his temperature rose to 103° F, and he complained of considerable pain in the leg, as he had had some tem-

perature before the operation, it was not thought that this was due to infection, but this was an erroneous idea, as within a few days there was evidence of infection of the wound. The stitches of the skin were removed and a large quantity of pus evacuated, afterwards the temperature fell and the patient was much more comfortable. The circulation remained good in the foot. Some days after the operation there developed a necrotic area about the size of a silver dollar on the heel, which was undoubtedly due to pressure, which should have been avoided. This is now practically well, but has given the patient more trouble than the popliteal wound. There was considerable contraction of the leg after removal of the splint, but he is now able to extend it to nearly a normal degree. There still remains an irritated scar in the popliteal region, which is probably due to the want of care which the patient has given it since he left the hospital. During his convalescence he took very large quantities of potassium iodide with impunity, and he is now taking 30 grains three times a day. There is no evidence of a redevelopment of the aneurism.

It was stated that in a number of other cases which have been reported an infection of the wound had taken place, but in none of them has it interfered with the cure of the aneurism. The fact that suppuration seems to be frequently in these cases would lead Dr. Gibbon in another case to insert a superficial gauze drain not into the sac, but down to it.

#### SUTURE OF FEMORAL ARTERY

DR FRANCIS T STEWART gave the details of a case of suture of the femoral artery. The patient was a young, robust man, whose femoral artery had been injured by a flying piece of steel, with the resulting formation of a large traumatic aneurism. At the operation, instead of applying a tourniquet, an incision was made directly over the sac and hæmorrhage from the vessel controlled from the wound. The sac was opened and the communication with the vessel sutured. There were no untoward post-operative effects, suppuration not occurring. The leg was kept elevated for two weeks. Pulsation in the artery was immediately restored and continued until the patient left the hospital. In answer to a question by Dr. Gibbon, Dr. Stewart said the length of time between the injury and the operation was about eight days.

## VARICOSE VEINS SIMULATING FEMORAL HERNIA, OPERATION, DEATH ON THE SEVENTH DAY FROM HEART-CLOT OF UNCERTAIN ORIGIN

DR WILLIAM J TAYLOR reported the case of a young woman, aged thirty years, who consulted him first on May 21, 1904, stating that she had been ruptured, and had tried to wear a truss, but this had given her so much discomfort and uneasiness that she was unable to wear it. At the same time she complained of quite extensive varicose veins of the left leg and thigh. He found a swelling over the left saphenous opening which had every appearance of being a femoral hernia. This swelling was soft, and could be readily reduced with slight pressure, there was some impulse on coughing, and when she lay down the whole mass disappeared. In view of this history the conclusion was natural that she had a femoral hernia which could not be properly retained by a truss, and that the pressure of the truss was producing the varicose veins.

On May 25 he operated at the Orthopædic Hospital, and, upon cutting down upon the mass, found it to be an enormous varicose condition of the saphenous vein. The whole vein below this point was thickened and indurated, and she had evidently had a venous inflammation extending down the whole leg. There was no hernia. The mass felt was this varicose condition of the saphenous vein. He ligated the vein below the enlargement, very carefully emptying the vein, and then ligated it about three-quarters of an inch from the femoral vein. He ligated it also once in the centre. She did very well for three days, when she complained of a great deal of pain in the stomach and abdomen. Now, on carefully examining her, was elicited a very good history of gastric ulcer, extending back over several years, and particularly during the past year. Dr Morris J Lewis was asked to see her, and he agreed in the diagnosis. Nitrate of silver and opium were given, and she was fed entirely by the rectum. All this time the wound was doing perfectly well, the drainage had been taken out, and it was practically healed. She improved markedly, and at once after the rectal feeding was begun, but about half-past two, on June 2, she called out to one of the women in the ward that she was fainting. The head nurse saw her almost immediately, and found her in a condition



of collapse, blue, and in an excruciating agony Dr Taylor saw her himself within ten minutes of this seizure, and found her in a most distressing condition, although she had somewhat revived. The pulse was very rapid, and practically imperceptible at the wrist, she was blue about the lips, in profound collapse, and with intense pain in the region of the stomach. The first impression was that a gastric ulcer had perforated. She was given hypodermics of salt solution with adrenaline added to it, hypodermics of atropine, digitalin, and inhalations of oxygen. Dr Lewis saw her later at half-past three. There was no abdominal rigidity, and, in view of this fact, it was concluded that the condition was one of heart-clot. She lingered on until Saturday, the 4th, at eleven o'clock, when she had a second collapse and died. During this whole time her pulse was always above 120, often 160, and she was kept alive simply by rectal stimulants, hypodermics, and oxygen. At no time was her general condition such that any surgical operation could have been attempted.

*Post-Mortem*—Post-mortem examination was made by Dr D J McCarthy. The examination, in brief, showed that she had a hæmorrhagic pericarditis and a clot in the auricle of the heart of the right side, which was dilated, and some myocarditis. There were no clots in either ventricle. The stomach showed an acute gastritis, evidently following upon an old and chronic condition, as there were two healed gastric ulcers, chronic gastritis at the pyloric, and acute gastritis at the cardiac end. The stomach was smaller than normal. The site of the wound was examined with care. The wound was entirely healed, there was no evidence of infection or of any untoward result, in fact, the wound was entirely well, but there was a small blood-clot removed from the left iliac vein just below the common iliac. The saphenous and femoral veins were normal. The etherization may have been a factor in producing excitement, which, added to her gastric condition, may account for the heart-clot.

DR JOHN B ROBERTS recalled an instance of unexpected death from a gastric condition not known to exist. Suprapubic operation for vesical calculus had been performed, and the patient was doing nicely, when abdominal pain developed and was shortly followed by death. Autopsy revealed a large gastric ulcer with cicatrized edges, perforation of which had caused the fatal peritonitis. There had been no symptoms of gastric ulcer,

and that condition was not suspected. The case, then, was one in which an operation wound was doing well, yet the patient suddenly died. A second case illustrates another point in Dr Taylor's paper, that of mistaken diagnosis. Six or eight years ago Dr Roberts operated upon a woman who, from the history and symptoms, was suffering from appendicitis. When the appendix was exposed it appeared perfectly normal, and, as it then was not customary to remove such appendices, the organ was allowed to remain. The patient recovered from the operation and was soon going home, when she sat up in bed and died instantly. Autopsy revealed fatty degeneration of the heart and kidney disease, although the urine had been reported as essentially normal. Cases of this nature belong to what have been termed the calamities of surgery. The patient died, although she did not have appendicitis as suspected. In such cases the friends, of course, attribute death to the operation, and thus make these occurrences doubly disagreeable to the surgeon.

#### PERFORATED GASTRIC ULCER

DR CHARLES F MITCHELL exhibited a specimen of perforated gastric ulcer recently obtained at autopsy upon a patient whom operation had failed to relieve. The patient was a motor-man, and was seen two hours after admission to the Pennsylvania Hospital. Two days previously he had been seized with sudden abdominal pain and fainted. The family physician sent the man to the hospital. There a diagnosis of peritonitis was made, and, because of the previous history of gastric catarrh, the origin was believed to be a perforated gastric ulcer, the entire abdomen was tender and rigid. Incision in the median line above the umbilicus was followed by escape of fluid under tension and the bulging of the omentum. Examination of the stomach showed a large opening in the anterior wall at a point supposed to be near the cardiac end. The stomach could not be drawn from the wound, and sutures introduced to close the perforation immediately pulled out. The man was in a desperate condition, so the lesion was packed off as well as possible and the abdomen washed out. The patient lived four days. At autopsy, two perforations of the stomach were found. The first, supposed to have been near the cardiac end, was near the middle of the anterior wall of the stomach, between the greater and lesser curvatures,

and the second in the greater curvature, and adherent to the pancreas

### CYST OF THE PANCREAS

DR R P McREYNOLDS presented a woman forty-nine years of age, who had been subjected by him to partial excision and drainage of a pancreatic cyst. The history was as follows. The woman had borne twelve children. Normal menstrual history. No inflammatory diseases of the pelvic organs. Two years ago, slight soreness in abdomen was first noted. Gradual enlargement of abdomen ensued, and finally prompted her to consult her family physician, Dr Mitchell, who sent her to hospital, where she came under the care of Dr McReynolds. She presented a tense, fluctuating tumor, which filled nearly the whole abdomen, which was symmetrically enlarged to the size of a full-term pregnancy. When the abdomen was opened, November 8, 1904, the omentum was found adherent to a large cyst sac which apparently filled the greater part of the peritoneal cavity. After the removal of eight or ten quarts of dark chocolate fluid from the cyst, the sac was partially drawn out through the abdominal wound, but its entire enucleation was found impossible on account of numerous adhesions, especially to the liver. Part of the sac having been cut away, the remains were stitched in the abdominal wound and its cavity packed with gauze and with rubber drainage-tubes. Though but little blood was lost, the shock manifested by the patient was very marked. From this, however, she was soon rallied, and she made thereafter an uneventful recovery. It was apparent at the time of the operation that the cyst had grown up between the stomach and transverse colon, the colon had been pushed down as far as the fibres. The fluid collected at the dressing the day after the operation showed the presence of pancreatic ferments.

DR W W KEEN approved Dr McReynolds's condemnation of puncture of the abdominal wall in order to get fluid for diagnostic purposes, this expedient is fraught with too great danger of perforating the stomach or colon. Dr Keen was one of the first surgeons in this country to operate upon a case of pancreatic cyst. The patient was a girl of fifteen. The cyst was the size of a head and presented in the epigastrium. Good recovery followed operation by essentially the same method as detailed by

Dr McReynolds Dr Keen believes that in very few cases is extirpation of the cyst justifiable

DR GEORGE ERETY SHOEMAKER saw a case of pancreatic cyst twelve or fifteen years ago in dispensary practice The patient was a woman of twenty, who had a tumor eight or ten inches in diameter presenting in the centre of the abdomen The diagnosis of ovarian cyst was made, but the patient refused operation Later she went to the University Hospital, where she was operated upon by the late Dr Goodell, who found a cyst of the pancreas The two layers of peritoneum and the cyst wall were stitched to the abdominal incision, and the patient made a good recovery

DR JOHN H GIBBON spoke of a case of pancreatic cyst under his care in the Pennsylvania Hospital fourteen months ago The patient was a colored man who had been kicked in the abdomen three days before admission There was no evidence of peritonitis or of any profuse hæmorrhage At the time of admission he complained of pain in the left loin, and there was a distinct tumor in the left renal region The day after admission this tumor had greatly increased in size, fluctuated, and was somewhat tender During the previous twenty-four hours the patient had passed but fourteen ounces of urine The tumor was flat on percussion and the colon was internal to it Diagnosis was made of hydronephrosis and operation advised An incision was made exposing the left kidney, which was perfectly normal In front of the kidney, however, could be felt the fluctuating mass, which was thought to be within the abdominal cavity The patient was therefore turned on his back and an incision made in the upper portion of the left semilunaris The abdominal cavity was found normal, excepting for some thickening of the gastrocolic omentum The stomach was pushed forward by the tumor The lesser peritoneal cavity was opened through the gastrocolic omentum, and a large cyst extending far over into the left side of the abdomen discovered The cyst contents were evacuated and the cyst walls sutured to the peritoneal edges The cyst contained a large amount of bloody fluid, which, on being afterwards examined, was found to possess the characteristics of pancreatic juice It was thought in this case that the man had probably had a cyst of the tail of the pancreas, which had given him no trouble until he received the blow in

the abdomen, which resulted in profuse hæmorrhage into the cyst cavity. The wound closed and the patient left the hospital perfectly well. He has not been heard from since.

### SARCOMA OF PELVIC ORGANS NOT CONTROLLED BY THE X-RAY OR BY COLEY'S FLUID

DR GEORGE ERETY SHOEMAKER said that some months ago he had occasion to report a sarcoma of the abdominal wall associated with an infiltration which united the rectum, uterus, left tube, and ovary, the growth not being considered removable after opening the abdomen. The wound was closed, and, after removing a generous piece from the superficial tumor for the microscope, the X-ray was applied for about nine months by Dr William S. Newcomet. The total number of exposures was forty-nine. The after-result, one year later, was the total disappearance of the growth from the abdominal wall, the gain of sixteen pounds in weight, and the disappearance of all pelvic enlargement except a slight increase in the size of the uterus. The case was originally referred to him by Dr M. B. Hartzell. The microscopical diagnosis was given by Dr J. Dutton Steele. The case was reported before the College of Physicians (*Transactions of the College of Physicians*, 1903, *American Medicine*, vol. vi, No. 26, December 26, 1903.)

He now reported another case which offered a contrast to the former favorable result, and though, from the circumstances which surrounded the patient, she was able to secure the very best conditions, and ample time was given to her treatment, no definite influence appeared to be exerted upon the progress of the disease either by the mixed toxins of Coley or by the prolonged use of the X-ray.

The patient was single, forty-six years old, and was referred to him by Dr A. A. Long, of York, Pa., because of a tumor in the right side of the abdomen, from which a sharp nodule projected against the right internal inguinal ring. As a right inguinal hernia had existed for six years, the pressure of the tumor against the hernia gave rise to a persistent pain and nausea, and was the principal source of the patient's distress. The tumor, which she had noticed about a year, reached to within an inch and a half of the navel on the right side, was nodular, sharply defined through the very thin abdominal wall, was evi-

dently connected with the uterus, and was movable. The inguinal hernia when opened was found to contain a pea-sized growth in the sac, which afterwards proved to be spindle-celled sarcoma. Radical cure of the hernia was done by the Bassini method, using kangaroo tendon.

On opening the abdomen in the median line with the intention of doing hysterectomy, the tumor was found to be made up of a number of small, tense cysts, very dark in color, protruding prominently from a fine granular base which was firm and solid. The uterus was completely covered in and its outlines could not be differentiated. No right broad ligament or ovary could be demonstrated, the growth involved the bladder superficially, and the rectum low down to a slight extent, and was not considered to be removable in the interest of the patient, though the entire mass, including the uterus, was movable. A nodule in the omentum was removed for examination and afterwards proved also to be sarcomatous. There was no unfavorable reaction from the operation, and immediately after aseptic convalescence X-ray was begun by Dr W S Newcomet, and continued with slight intermission two or three times a week for about three months. While the patient at first improved in nutrition, no definite effect could be produced upon the size of the growth. Because of the radical cure of the hernia, it was no longer pressed upon by the tumor, and a distressing source of pain and nausea was completely removed.

The systematic use of the mixed toxins recommended by Dr Coley was begun with a half-minim dose and gradually increased one minim per day. Reaction first occurred with twenty-one minims of the undiluted preparation. After this was secured, the injections were continued for seventeen days under his own observation in the hospital, and for several weeks longer in the very careful hands of her physician at her home. Though typical reactions were produced and though every possible arrangement was made for surrounding the patient with the best possible conditions, no permanent effect on the tumor was produced by the treatment, while the long-continued series of reactions was somewhat exhausting. The greatest amount of Coley's fluid used at one time was thirty-two minims. Specific treatment of the tumor was now abandoned. The patient gradually lost ground, and death occurred from exhaustion fourteen months after the operation.

The cystic degeneration of the sarcomatous growth probably rendered it less amenable to successful treatment by the X-ray. It was somewhat of a disappointment, however, to find that the toxin treatment failed to influence a sarcoma of the spindle-celled variety, which is the form most favorable for its use. Careful watch was maintained upon the blood condition during the use of both of the agents referred to, but no definite effect appeared to be produced upon the leucocytes. The lowest count was 6000 and the highest 10,600. The latter count was obtained during the period of X-ray treatment, and led to a cautious increase of interval so as to avoid breaking down the growth. The lowest hæmoglobin was 62 per cent and the highest 79 per cent. The lowest red-cell count was 3,856,000 and the highest 4,960,000. Much of the improvement in the general condition of the blood occurred during the treatment with the X-ray, and may have been largely due to general hygienic and roborant measures, which were systematically carried out. Improvement in nutrition was also favored at this time by the absence of pain in the tumor and by its disappearance from the site of the former hernia.

DR JOHN H. JOPSON spoke of a round-cell sarcoma of the neck upon which the combined treatment was used with marked success. The tumor was situated above the clavicle, and was the size of an orange when operated upon in May, 1904. Operation was difficult and the tumor could only partially be removed. It extended below the clavicle, into the anterior mediastinum, and along the posterior triangle of the neck. The internal jugular vein was infiltrated, and was torn three times during the dissection. The prognosis was very bad, but under treatment by Coley's fluid and the X-ray the infiltration remained stationary for some months. The fluid was begun with minimum doses and increased until thirty-five or forty minims were reached. Finally, the tumor again enlarged, and further operation was considered and also advised by Dr Willard. In December, 1904, the second operation was performed, and this showed that the infiltration of the posterior triangle and of the mediastinum had disappeared, and what remained of the tumor in the old site was surrounded by fibrous tissue in the form of a capsule. This made removal of the entire mass comparatively easy. Now, ten months after the first operation, there is some limited induration at the site

of operation, but the patient's general health is good, and he is in excellent physical condition

## APPARATUS FOR RETAINING PATIENT IN ANY DESIRED POSITION

DR W W KEEN showed a posture retention apparatus, saying that it was demonstrated on board the Athos during their

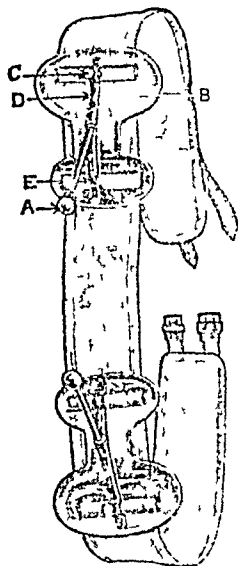


FIG 1—A The retaining arm with ball attachment B The conformity supporting plate C The thumb clamp for adjusting plate, B, on the bandage for retaining the body at any angle or in any posture D is a rib secured to the conformity plate, this rib possessed with elevations, E, under which the bandage (or belt) passes these elevations to allow of readily attaching and detaching the belt for washing

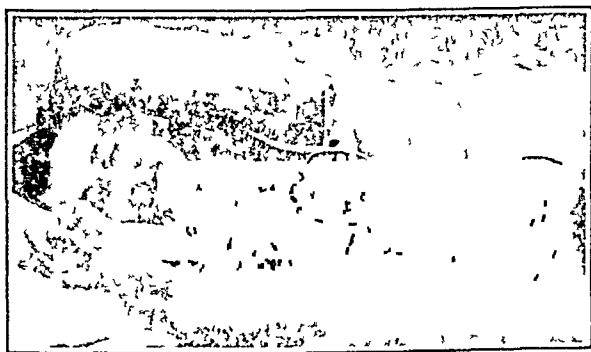


FIG 2 shows patient being retained to the side during operation, two retainers (as seen in front resting against the operating table) are also on the back, thus the body is held rigidly to the lateral posture

recent unfortunate trip to the tropics, by Mr Lees, of the Physicians' Supply Company of Philadelphia The apparatus is simply



a pair of broad bands of canvas, to each of which are attached two buckles carrying projections six inches long and terminating in spheres approximately three centimetres in diameter. It is used to retain patients in any position while sleeping, as, if properly applied, they cannot turn without first waking. While particularly to be used after operations, Mr. Lees believed it might also be of use in preventing nocturnal emissions. Dr. Keen also suggested that it would be useful in keeping patients in the lateral position during operations upon a kidney, the ilium, etc., as every surgeon knows the difficulty in keeping such patients from turning upon the back or face. He recently employed the apparatus upon a man from whom he removed a tumor of the buttock, applying one under the armpits, the other just below the hips. They retained the patient in the desired position throughout the operation without any difficulty, and were in every way satisfactory. The only objection to them is that they may cause pressure upon the chest, thus preventing free respirations. If modified by providing a slit for the arm or some similar device, they possibly might be employed for Estlander's or Schede's or other operations upon the chest requiring the lateral position.

# TRANSACTIONS

OF THE

## CHICAGO SURGICAL SOCIETY.

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*Stated Meeting, February 6, 1905*

D A K STEELE, M D , in the Chair

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### ANKYLOSIS OF THE JAW

DR EMIL RIES reported the case of a man, twenty-one years of age, who was sent to him from Indiana six months after he had acquired syphilis. The patient's syphilis was at first treated by some irregular practitioner in an unknown way, and grew worse rapidly. He soon began to have ulceration of the mouth, though he did not remember ever having been salivated, and it was not known that this practitioner gave him mercury. At any rate, ulceration of the mouth began, and when the young man consulted a regular practitioner he was in a very bad condition. His tongue was swollen enormously, he could not close his mouth, his mouth was full of ulcerations, he lost almost all of his teeth on the left side, large pieces of bone began to come out. One day a very severe hæmorrhage from the mouth took place, which the doctor had difficulty in controlling. Then under antisyphilitic treatment this very bad condition became a little better, so that the tongue retired into the mouth and the patient could close the mouth. Very soon, however, he found that, whereas before he was unable to close his mouth, now he was unable to open it. The teeth of the left side having largely fallen out, he was able to feed himself on that side with a spoon, taking liquid food only. He noticed that part of the liquid food always escaped through the nose, so that feeding was rather difficult. At first his nutrition was very poor, he went down rapidly, but

gained in weight under antisyphilitic treatment and careful feeding, so that when he came to Chicago in November he was in fairly good general health. In October, when Dr. Ries first saw him, he still had syphilitic ulcerations in the mouth which did not heal quickly, and he gave directions for specific treatment. When he returned in November he could not move the lower jaw, half of the horizontal ramus of the jaw on the left side had disappeared, with the angle of the jaw. Between the condyloid process and the jaw there was only ligamentous union by cicatricial tissue. The median line of the lower jaw corresponded vertically with the left nasolabial fold, the jaw being pulled over to the left side. There was a perforation of the hard palate, there was a perforation of the septum. There were condylomata on the penis, the chancre was still hard, the glands were enlarged all over the body, but there were no mucous patches, no eruption on the skin. It seemed that the man was as much troubled by the bad mutilation of his face in consequence of the absence of the angle of the jaw as by his inability to open the mouth. He desired very much to have something done for the caving in of the left side of his face, and, in determining upon the method to be followed in the operation, the speaker took that into account, and instead of making an incision along the zygoma, as would ordinarily be practised, he decided to do an operation which would permit him to insert a sufficient artificial support for his face to make the left side correspond more to the other side. He intended to insert sufficient ivory pegs to give the appearance of a natural jaw. He therefore made an incision below the horizontal ramus, or where it ought to have been, and continued it up behind the ascending ramus, then dissected his way down to the bone and to the cicatricial tissue, and dissected out the facial nerve and its branches carefully so as to avoid wounding them. After they had been dissected out they could be seen beautifully, he raised these parts forward, and on the left side tried to remove the condyloid process, which was firmly adherent to the skull. The coronoid process was buried in scar tissue, with the scar tissue extending down into the mucous membrane of the mouth, so that he was in considerable danger of opening into the mouth, an occurrence which he was particularly anxious to avoid to guard against infection of the wound. He succeeded in avoiding opening into the mouth, and could resect with the chisel the condyloid process

The coronoid process, which fastened the rest of the jaw to the scar tissue, he dissected out subperiosteally. Then he expected the jaw to be fairly movable. It was not. It was just as solid as it was before. Even after the condyloid process had been removed completely, there was no possibility of moving the jaw. He therefore decided that it would be necessary to operate on the other side also, and he sutured the pterygoid muscle out between the skull and the external soft parts so as to avoid new bony formation between the base of the skull and the jaw. He then proceeded in the same way on the right side, but it was sufficient to resect the condyloid process, as the coronoid process had not interfered sufficiently with the motion, and he again sutured the pterygoid muscle out between the skull and the rest of the descending ramus of the jaw. On the left side, after having finished the dissection, he drilled holes into the jaw and inserted ivory pegs. At first he had two pegs ready, but found that, if he drilled a sufficiently good hold for the second peg, he would run considerable risk of getting into the alveolar process and of opening into the mouth, and, of course, one could not expect pegs to hold for any length of time if they were in contact with the mouth cavity in any way. He therefore left one peg in place, which he could insert into the horizontal ramus, and which healed in beautifully. The wounds were closed completely by sutures, without drainage, and healed by primary union. At the end of the operation it was possible to open the mouth sufficiently to insert a good-sized piece of bread, or anything of that kind, so that the man would be able to eat solid food.

In the after-treatment he insisted on early and frequent passive motion, then he began to teach the man to speak again. His speech, when he came to him, was mumbling, very indistinct, in consequence of the formation of scar tissue in his mouth, and he actually had to relearn to speak. At the end of six weeks' treatment his mouth was clean and all right, the wounds were all healed, his mobility was very fair, and he proceeded to have a dentist insert a plate, first of all covering the opening into his nose, the perforation of the hard palate, and, secondly, to enable him to chew. He was then able to chew food, if it was not too hard, and when he left the hospital, about eight weeks after the operation, he was in good condition, and his face looked quite natural. There was still a little caving in on the left side, but the

ivory peg held up the skin so well that there was a marked apparent angle of the jaw, and the deep cavity which had existed at first on the left side had disappeared. Now, that the peg had healed in, he thought it would be an easy matter to build up with paraffin the side of the face, as there was something to build up on. The patient was going to return soon to have some more dental work done, and at that time the speaker expected to inject some paraffin.

### EXTENSIVE RECTAL STRICTURES

DR RIES described a case which he had reported, first, seven years ago. At that time he operated upon a woman with syphilis of long-standing. She came to him with the complaint of constipation, vomiting, cachexia, suppuration from the rectum and vagina, and in whom he found on examination the following choice selection of conditions. Syphilis, with skin eruption, general enlargement of the glands, extreme cachexia, so that the woman, instead of weighing 160 pounds (her former weight), now weighed only eighty pounds, complete laceration of the perineum, rectovaginal fistula, stricture of the rectum, low down, and very tight, so that he could barely introduce a thin probe, laceration of the urethra, cystic tumors of both ovaries of moderate size, say about the size of a goose-egg. On vaginal examination the uterus was found atrophied and high up. Behind the uterus he found a hard mass, the nature of which he could not explain. He thought it was a case of mesosigmoiditis, which was associated frequently with ulcerative processes low down in the rectum or higher up in the sigmoid. He intended to resect the stricture of the rectum and bring down the sigmoid and attach it to the sphincter ani. He proceeded accordingly (June 19, 1897) through the vagina, and as he split the fistula he found it went through into the stricture. Above the stricture there was ulcerated rectal mucous membrane, and going higher up he came into the peritoneal cavity. In the peritoneal cavity he found a hard mass higher up, which was not simply a mesosigmoiditis, but a second stricture of the rectum, so that the following conditions confronted him. Diagram (Fig 1) shows the symphysis, the bladder, with laceration of urethra, the vagina, with the uterus, the lacerated perineum, and fistula which led into the rectum.

Then the sacral bone, the upper stricture, the dilated, ulcerated portion of the rectum, with the lower stricture. After he had opened into the peritoneal cavity, it was clear that he could not have pulled down the bowel above the upper stricture from below without running serious risk. So he turned the patient round and did a laparotomy. The descending colon was loose to such an extent that there was a distinct mesentery, so that he cut

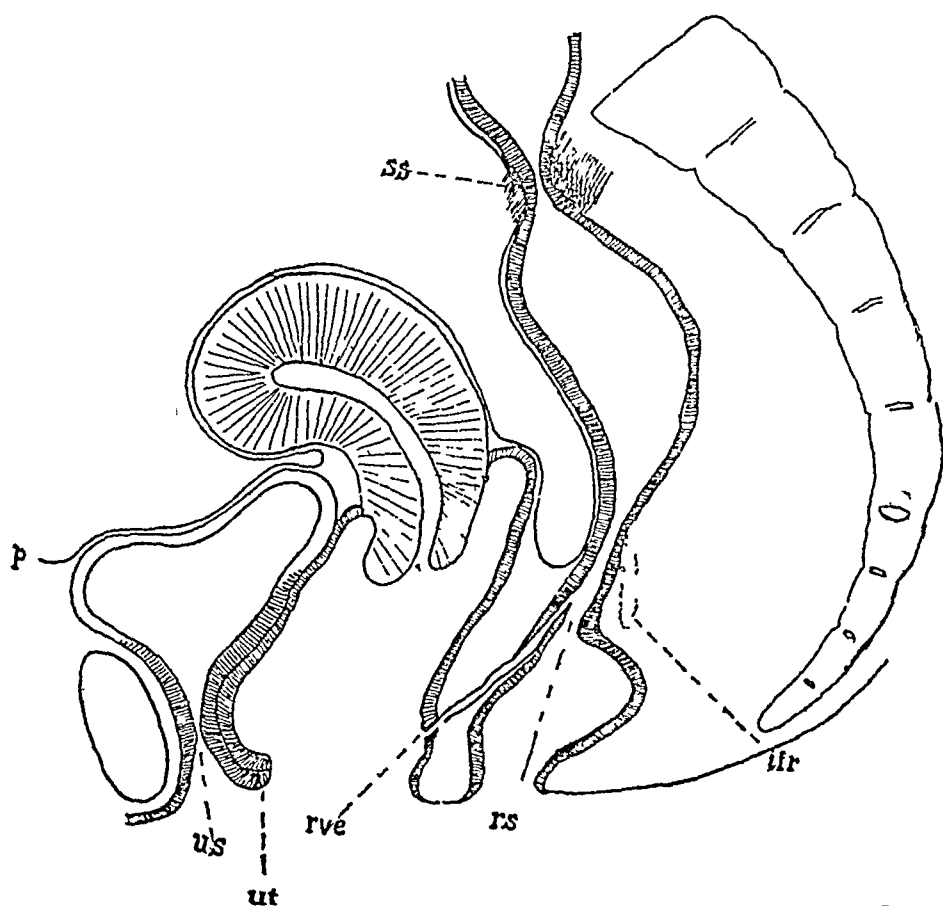


FIG 1—Condition before operation *p*, Peritonæum *ss*, Stricture of sigmoid *rs*, Stricture of rectum *ifr*, Internal fistula *rve*, Rectovaginal fistula *ut*, Urethral tear *us*, Urethral stricture

through above the upper stricture, and closed the lower part of the bowel completely. He took the descending colon, pulled it down through the opening in the cul-de-sac, and inserted it above the anus. There were therefore at the conclusion of the operation two rectums, a new one, which was made of the descending colon, and the old one, which contained two strictures, and an ulcerated area (Fig 2). The anastomosis was made by sutures

In other words, exclusion of the lower part of the bowel was performed. The woman made a smooth recovery, gained in flesh rapidly, and had no difficulty with her bowel movements after that for five years.

He reported this case to the Chicago Medical Society soon after it was operated upon. He also reported it to the Mississippi Valley Medical Association five years after the patient had been

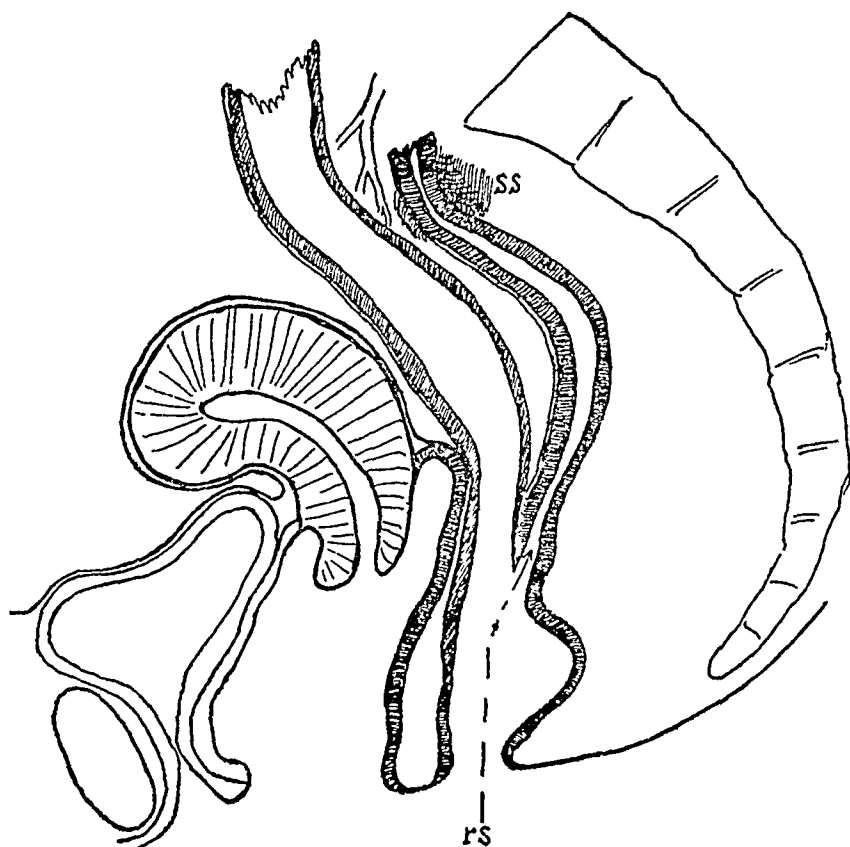


FIG 2—Operation completed rs Rectal stricture ss Stricture of sigmoid

operated upon, when she weighed 160 pounds. At that time she was in perfect health. She complained of nothing, had done nothing for her syphilis, and could not be induced to take any kind of treatment. He saw the woman again two months ago, when her weight had been reduced to ninety-six pounds. She was cachectic, and the new rectum was as much strictured as the old one was before. The excluded bowel had shrivelled up com-

pletely, so that it was impossible to introduce a probe more than an inch. The rest was all closed up apparently by a cicatricial mass. The new artificial rectum had become strictured also, but the stricture was not so tight but what one could introduce a good-sized flexible bougie. The mass of cicatricial tissue around it was so extensive that there was little doubt in his mind but what the rectum would close completely. The body was covered with a specific eruption.

So far as he knew, this was the first case ever operated upon in this manner. The second case was operated upon by Rotter, of Berlin, about five weeks after Dr. Ries operated on his case, and that gentleman published a report of his case about ten months after he had operated, *that is, over eleven months after Dr. Ries operated*, he having the same idea in view. This gentleman had operated upon two additional cases since. One patient was dead, while the other two survived. Both had a recurrence, one two, and the other three, years after operation. Dr. Ries's case was the only one that had remained free from recurrence for over five years. He operated on her again last Saturday. It was interesting to go into the abdomen to see what the organs looked like at present. He expected, if he could get enough slack, enough movable colon descendens or transverse colon, to repeat the operation, and take the transverse colon and place it between the sacrum and vagina, and use it for a rectum. When he got in he found there was no slack. The descending colon, which was stretched at the time of the first operation, was smooth and laid almost immovably against the abdominal wall on the left side. There was no mesentery now on which to pull and drag in order to get the colon down to the sphincter ani. The transverse colon was not sufficiently movable to be cut in two and taken down into the pelvis. He therefore decided to do a colostomy, which he performed on Saturday. The woman was doing well so far.

DR JACOB FRANK said that Dr. Beck had exhibited a case at a previous meeting of the Society in which he had excluded a portion of the bowel, and described a peculiar formation which took place in that excluded portion. He had had the same experience as Dr. Beck with regard to exclusion of the bowel, and also had demonstrated the same in experimental work on dogs. He did not know whether in Dr. Ries's case part of the bowel was completely excluded, or whether there was an opening at the



lower part, and he would like to have Dr Ries speak of that in his closing remarks. He could not describe very well the particles of material that formed in the bowel, but so far as he could judge, they appeared to be of a cheesy nature, rolled up in little balls, and sometimes this material formed in such quantities that it gave patients excruciating pain. In one case, a woman, he had operated upon, the suffering was considerable, and he always thought when she came to him she complained simply of nothing. Why she complained, he did not know, because her bowels were moving, but the pain became so excruciating that he finally operated again, and found the condition he had mentioned. He would like to know whether Dr Ries found anything of this kind in his case, or whether there was an opening through which the material could escape. This was the first case he knew of where the bowel became completely contracted to a small tube if both ends of the bowel were completely closed.

DR RIES said, in reply to Dr Frank, that the descending colon, which was pulled down, was inserted into the rectum just above the anus, and was not excluded at both ends, but only at one end. The excluded bowel was in an ulcerated and syphilitic condition, so that there was very little epithelium left. His patient was not bothered by the sebaceous or cheesy masses referred to by Dr Frank. At first, there was a sort of mucous discharge from the rectum, but this soon stopped, and now one could not introduce a sound very far.

#### STRICTURE OF THE ŒSOPHAGUS FOLLOWING TYPHOID FEVER

DR S C PLUMMER presented a case of a young man, seventeen years of age, who, on September 21, 1903, took to his bed with typhoid fever. On October 15, while apparently convalescent, he suffered a relapse, and was severely ill for more than three weeks longer. Liquid diet was continued until about November 12. On this date he partook of semisolid diet for the first time, and noticed difficulty in swallowing, with frequent choking. This condition gradually grew worse, and about December 10 the attending physician began passing œsophageal sounds each day, until December 19, when patient was removed to another hospital. From December 19, 1903, to February 25,

1904, he received no treatment for the stricture, but from that date on a whalebone sound, with steel olive tips, was used

On April 12 he became unable to swallow anything, even liquids, and was nourished by rectal alimentation. On April 18 he entered Wesley Hospital, Chicago, and on April 21 was anæsthetized with ether. An unsuccessful attempt was made to pass bougies of various sizes, and Dr Plummer then proceeded to do a gastrostomy, using a vertical incision, with separation of the fibres of the rectus muscle, as advised by von Hacker. As it was impossible to enter the œsophagus through the cardiac orifice of the stomach, the stomach wall was stitched to the edges of the parietal peritoneum, and then opened. The edges of the stomach wound were not stitched to the skin, but brought up only slightly into the wound, and a drainage-tube inserted. It was not the aim to make a permanent fistula lined with mucous membrane, but it was hoped that the stricture of the œsophagus would relax, and the gastric fistula, after serving as a temporary route for nourishing the patient, might be allowed to close.

On April 27, six days after the operation, the patient could again swallow liquids. On the following day an attempt was made to pass a small bougie, but unsuccessfully. Several similarly unsuccessful attempts were made during the next few days. On May 4 the stricture again closed, so that liquids could not be swallowed, and on July 21 he gave up all hope of ever dilating the stricture, and the patient left the hospital. At this time he was strong and well nourished.

On August 26 he could again swallow liquids, and he returned to the hospital September 4. Attempts to pass bougies were unsuccessful, as before, so efforts were directed to getting something through the stricture by swallowing. Repeated efforts on the part of the patient failed, but on September 29 he informed Dr Plummer that he thought a very fine silk thread had passed through. His stomach was quite full at the time, and upon removal of the tube, which was kept clamped with an artery forceps, there was a free escape of stomach contents, and the end of the thread floated out through the fistula. A heavier thread was at once attached to the mouth end of this one and drawn through the stricture, and to this a still larger thread attached and drawn through. The two ends of the latter were then tied together, first passing the stomach end through the drainage-tube. Each day

a larger thread was drawn through, and finally three of the largest were in place at one time. On October 18 a small drainage-tube was drawn through the stricture and allowed to remain two hours, then withdrawn, to be again drawn into place the next day. Every few days the size of the tube was increased, until early in January, 1905, a No. 14 catheter was used.

On January 11 the string was removed and the drainage-tube taken out of the fistula. A bougie was then passed through the stricture per mouth, and this had been continued every day or two up to the present time, when a No. 23 œsophageal bougie could be passed with ease.

On January 5, 1905, he began giving the patient thiosinamin, three grains, once a day. On January 12 this was increased to three grains twice a day, and on January 27 to three grains three times a day. On February 3 this was stopped, as patient complained of a feeling of weakness, which might, however, have resulted from his eating but a small amount of food, owing to the fact that his abdomen was strapped rather tightly with adhesive strips in the effort to close the fistula, and food when taken, except in moderate quantities, distressed him. The administration of the thiosinamin made it possible to increase the caliber of the bougies, and more rapidly than ever.

The fistula at this time (February 6) was about the diameter of a lead-pencil.

### COLLOID CARCINOMA OF THE CÆCUM

DR PLUMMER reported the case of a female, aged twenty-five years, who in the summer of 1901 was seized with pain in the right iliac region. The onset was gradual, and followed in about forty-eight hours by vomiting and high fever. She remained in poor health for six weeks, when a diagnosis of appendicitis was made, and appendix removed. She recovered slowly after operation, but complained chiefly of weakness.

In August, 1903, patient began to have attacks of pain, vomiting, and fever, lasting ten to fourteen days at a time, with intervals of several weeks. Pain was cramping in character, and more generally distributed than before. The latter part of July, 1904, she noticed a slight swelling in the right iliac region. She had pain in the right iliac region, which radiated at times into

the right lower and upper extremities. She experienced some difficulty in walking. There was much distention of the bowels by gas, with constipation.

Examination revealed a firm mass, not adherent to the abdominal wall, with limited mobility.

Operation, September 22, 1904. A small incision was made over the tumor, and when the nature of the tumor mass was recognized, by examination through this opening, a long median incision was made. The ileum was divided near its lower end. Since it was found that the ascending mesocolon contained enlarged lymphatic glands, almost the entire ascending colon and its mesocolon were removed along with the cæcum, the colon being cut across near the hepatic flexure. The ends of the divided bowel were closed by two rows of sutures, and a lateral anastomosis was made by a Murphy button between the ileum and the transverse colon. The ileum was dilated and its walls much thickened. The abdomen was closed without drainage.

The patient had a tedious convalescence. For many days she suffered from great abdominal pain, with occasional emesis, and got very little sleep. Gradually, however, she improved, and on October 25 sat up in bed. The button did not pass until October 23, thirty-one days after the operation. On October 27 she was up in a wheel-chair, and on November 3 walked. When she left the hospital, November 24, 1904, she was in a fair condition, and when seen last, about January 1, 1905, was in vigorous health.

The fresh specimen showed the walls of the cæcum much thickened and indurated, with the lumen so reduced in size that the little finger could not be passed through it. Adherent to the cæcum was a colloid mass, almost the size and shape of a hen's egg, and there were several similar masses of smaller size in the immediate vicinity.

#### SARCOMATOUS DEGENERATION OF UTERINE MYOMA

DR E C DUDLEY exhibited a gross specimen and some slides of this case, and said that it was generally understood that sarcoma might develop from any of the following structures:

- 1 The interglandular connective tissue of the endometrium
- 2 The intermuscular connective tissue of the myometrium
- 3 The walls of the blood-vessels
- 4 Perivascular connective tissue
- 5 The muscle cells
- 6 Any of the structures of a uterine myoma

In the interesting specimen under consideration, it was evident from gross appearances that the sarcoma had developed from a uterine myoma. Before operation, the sarcomatous structure filled the uterine cavity, and felt on intra-uterine palpation like a retained placenta, in fact, was so pronounced by two excellent diagnosticians. Microscopic sections taken from various parts of the growth showed it to be a small, round, and spindle-celled sarcoma, the sarcomatous cells being substantially of the same size as the red corpuscles. The interesting features of this specimen were (1) A rather sharp demarcation between the sarcomatous cells and the myomatous cells (2) Presence in many parts of the sarcoma of clearly defined blood-vessel walls (3) The transition in the character of the blood-vessels from those which have walls to those which are mere blood-spaces.

In this case complete abdominal hysterectomy was performed on the 17th of November, 1904. There was nothing unusual in the operation or in the subsequent recovery of the patient.

## REVIEWS OF BOOKS.

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MANUAL OF OPERATIVE SURGERY By JOHN FAIRBAIRN BINNIE,  
A M , C M (Aberdeen), Professor of Surgery, Kansas City  
Medical College, etc Philadelphia P Blakiston's Son & Co

This work on operative surgery is of exceptional merit In a preface addressed to Dr Robert F Weir, to whom the book is dedicated, its scope is stated It is not intended to describe the standard and well-established operations as done on the cadaver, but is rather a manual of the more recent advances along many lines

Certain sections are omitted, viz , operations on the arteries, on bones, on joints, on the extremities, on the female pelvic organs, etc Yet the number of things contained in this small book, which the average busy surgeon wants to know, is simply astounding While it is not by any means devoid of originality, it still covers most of what is best in the recent literature of surgical operations It shows a full acquaintance with the latest work of the various surgeons who have made material advancement along the lines to which they have devoted especial attention, when such attention has been crowned by success Thus it is more comprehensive than a "one-man book"

To enumerate the many sections that will interest the reader may be unnecessary, but special attention may be drawn to some of them

The book begins with a description of the modern methods of opening the skull, and continues with an excellent account of the operations for infectious conditions due to middle ear disease, laying stress on the advantages of using a burr-drill

The description of the plastic operations on the face, chin,

lip, etc., contains Brophy's methods of closing cleft palates, well illustrated, from *Dental Cosmos*

The chapters on the removal of cervical tumors and glands encourage systematic, operative attack, and give details and reasons for the various steps which, if followed, would improve our work

The total excision of the cervical sympathetic is described according to Jonnesco

Kocher's plan of dealing with the thyroid gland is given and illustrated

Ten illustrations show the various methods of closing the abdominal wall, and the author concludes his few remarks on the subject with the statement that "after completing a prolonged operation on an exhausted individual, it is better to have a post-operative hernia in a living patient than a perfectly closed wound in a corpse"

The chapter on stomach surgery is especially strong and chronicles the advanced work of many surgeons, especially Mayo Robson and the Mayos. It includes some excellent illustrations

In the section on the intestines, he advocates suturing without mechanical devices, and recommends an enterostomy in debilitated cases of intestinal obstruction. Our knowledge of appendicitis operative methods is well classified and succinctly stated

He warmly advocates the "Fowler position" in the after-treatment of peritonitis. His use of iodoform gauze drainage and of the Ochsner plan of treatment of cases over forty-eight hours' duration will not be universally accepted. In the abundant use of gauze packing in abscess cases and its retention for ten days, he differs from the practice of some operators

The short but excellent chapter on the bile ducts is to be especially commended, and it has many references to Robson and Mayo

Hernia is well treated and the improved Johns Hopkins operation for inguinal, and the Mayo operation for umbilical,

hernia are given the space they well merit and are fully illustrated

About one-sixth of the book is devoted to genito-urinary surgery, and includes the recent advances in this department

Six methods for nephropexy are given and some of the advantages claimed for each. The other operations on the kidney are given due attention, but he is non-committal in reference to Edebohls' decortication procedure. In the chapter on the ureter, he has made free use of Morris's work, and could have found no better authority.

The various methods of dealing with paralysis by tendon transplantation are described and credit given to Vulpius and others.

Many other chapters might be mentioned as showing the scope of the work. In the perusal of the entire book, one is impressed with the fact that, to a great extent, only the more recent authorities are quoted. The very latest surgical literature is embodied in the book. While an active surgeon, who is also a student, may be acquainted with the very article quoted, it is convenient to find it at hand on one's desk rather than in less accessible journal files. It is, however, much more than a compilation. The vigor and good judgment of the author are everywhere apparent.

WALTER C. WOOD

THE SURGERY OF THE DISEASES OF THE APPENDIX VERMIFORMIS AND THEIR COMPLICATIONS. By WILLIAM HENRY BATTLE, F R C S, Surgeon to St Thomas's Hospital, and EDRED M. CORNER, F R C S, Surgeon in Charge of Out-Patients, St Thomas's Hospital. Chicago: W. T. Keener & Co., 1905.

A book which can be read with interest and pleasure by the surgeon, and which is certainly a most valuable source of instruction to the general practitioner, as it is he who is usually first called to see the cases described, and upon whom rests the



responsibility of deciding when the surgeon shall be called in consultation, of urging upon the family or friends of the patient the need of haste that valuable lives be not sacrificed by unnecessary delay and waste of time

Beginning with a brief history of the disease and its surgical treatment, the authors follow with a most complete description of the anatomy of the appendix, macroscopical and microscopical, its development, physiology, and relation to neighboring organs and the abdominal walls

Almost forty pages are devoted to pathology and diagnosis, comprising really two most important chapters of the book

There are but three criticisms to be made against the chapters devoted to treatment

First The authors recommend rubber gloves only in cases complicated by pus We believe that gloves are *always* to be worn in this or any surgical procedure, whether pus be present or not

Second The evident preference given to silk as a suture material, when *absolutely* sterile catgut can always be obtained, plain or chromicized, of any desirable size from reliable manufacturers of surgical dressings

Third While the search for and removal of the appendix in cases with abscess may add somewhat to the risk to the patient, we believe it better to take that risk rather than close the abdomen, leaving such a factor for immediate or future trouble behind us

The method of removal of the appendix described on pages 83 and 84 is quick, clean, and saves time, as we have proved on several occasions

Chapter XII should be of special interest to all who are in any way connected with life insurance Many companies now insure for or against appendicitis

J RICHARD TAYLOR

"FRACTURES DE LA EXTREMIDAD INFERIOR DEL HÚMERO EN LOS NIÑOS" "FRACTURES OF THE LOWER EXTREMITY OF THE HUMERUS IN CHILDREN" Thesis presented by PEDRO CHUTRO Gr 8vo, pp 577, Figs 165 Buenos Ayres J Peuser, 1904

This volume contains the results of Dr Chutro's study of 106 elbow fractures in children observed by him during the period of five years from April, 1899, to April, 1904. During this time there were treated in all 361 cases of fractures in children, the fractures of the lower extremity of the humerus observed thus forming nearly 30 per cent of the whole number. Of the 106 elbow fractures, 35 were supracondylar, 29 were epiphyseal separations, 28 were fractures of the external condyle, 2 of the internal condyle, 5 of the epitrochlea, 2 were classed as T-fractures, and 5 Dr Chutro terms diacondylar, of the type Posadas. This last classification, named after the lamented Dr Alexander Posadas, who first clearly described its pathological anatomy, is, as its name implies, a more or less transverse diacondylar fracture, its special feature being that the epiphyseal fragment of the humerus has become dislocated forward and downward into the flexure of the elbow, while the bones of the forearm form a false joint posteriorly with the lower end of the diaphyseal fragment of the humerus. Although the deformity is much the same as in that type of recent fracture described by Kocher as "supracondylar fracture by flexion," and though, as Chutro points out, fractures which were probably of this type have been described with more or less distinctness by various authors from the time of Cruveilhier (1829), yet no one appears to have studied the lesions accurately but Posadas himself.

The author of this work is to be sincerely congratulated upon the thorough and painstaking manner in which he presents his studies. His conclusions are amply justified in nearly every instance by the excellent series of skiagraphs and photographs with which his arguments are accompanied. The appearance of the

limb on admission is shown in a photograph, a skiagraph shows the bony lesions present, a complete clinical history is given, and when the patient is discharged he is again photographed and skiagraphed, to show the limits of extension and flexion in the elbow-joint, and the bony union obtained. Surprising success has attended the treatment in most of the cases, and this is no doubt in large part due to the adoption of acute flexion as the routine position for the elbow. Chutro gives Dauvergne (1873) the credit of introducing this method which is so widely known by Jones's name. Passive motion and massage are commenced at the first dressing, on the third or fourth day, and not until from five to six weeks have passed are bandages entirely discarded and gymnastics commenced. In our own opinion, it is safer not to begin massage or passive motion, except so much motion as is required to unfold and bathe the fold of the elbow, until the end of the second week, and if this be done we think it totally unnecessary to retain the bandages in the vast majority of cases beyond the fourth week. It also appears to us that Chutro depends upon the Rontgen rays for diagnosis to an unnecessary and inexpedient degree.

Chutro's experience with the operative treatment of elbow fractures appears to have been unusually extended. This is so, not because the cases under his own care required operation many times, but because children from the surrounding country for many miles appear to have been habitually referred to his department of the hospital. It is worthy of note that the cases thus sent in for operation had been treated, if any form of treatment had been employed, almost exclusively by the application of plaster casts, the result, as is frequently the case, being that the deformity recurred as soon as the cast became loose through the subsidence of the primary swelling, and that as a consequence the child was left with an ankylosed joint. In most of these cases he employed a single external longitudinal incision, reaching the humerus and radius through the intermuscular septum, then he separated the soft structures and the periosteum as a bridge from

the anterior surface of the joint, loosened the fragments, and replaced them in their normal position, cutting away so much of the callus or irregular edges of bone as was requisite. The arm was then dressed in acute flexion, and the case treated as a recent fracture. Formal excision of the joint is not employed, and, except in the cases of diacondylar fracture of the type Posadas, it was not found necessary to employ an internal longitudinal incision in addition to that formerly described.

In fractures of the external condyle, with complete rotation of the fragment, an injury very difficult to treat satisfactorily on conservative lines, Chutro employs immediate operation, restores the fragment to its normal position, and fastens it in place by periosteal sutures of catgut. He does not mention the method of nailing the fragment in place, and avoids metallic sutures whenever possible.

This volume may be considered a complete review of the subject of which it treats up to the present. The history of each variety of fracture is outlined, and the literature of the subject has been searched with a thoroughness which it would be difficult to exceed. A copious bibliography is appended, which is especially complete in American, English, and French references, the German literature is not so well represented. A fault in the book is the absence of an index, this lack is probably to be explained, however, on the ground that the work was presented as a thesis. As a whole, nevertheless, Dr Chutro's book presents the best study of fractures of the lower extremity of the humerus which has been published in many years, and as far as illustrations alone are concerned it is certainly not excelled. Even to those who do not read Spanish, the magnificent series of photographs and radiographs will tell their own tale very largely, and will well repay careful study.

ASTLEY PASTON COOPER ASHHURST

A LABORATORY MANUAL OF HUMAN ANATOMY By LLEWELLYN F BARKER, M B (Tor ), Professor and Head of the Department of Anatomy in the University of Chicago and Rush Medical College, Assisted by DEAN DE WITT LEWIS, A B , M D , and DANIEL GRAISBERRY REVELL, A B , M B , Instructor in Anatomy in the University of Chicago Illustrated Philadelphia and London J B Lippincott Company, 1904

It has been a great pleasure to review this book, first, because it is by far the most important work on practical anatomy that has appeared in recent years, and, second, because it sounds the new note in the modern teaching of anatomy

In no branch of medical science have the methods of teaching received more radical change than anatomy A few years ago the didactic lecture was the principal feature in the anatomical curriculum The lecture was supplemented by dissections carried on in ill-lighted, badly ventilated, unhygienic rooms, where, through the blue haze of tobacco smoke, the student identified the grosser structures

The changes wrought during the past decade have been modifications in methods, manners, and valuations The value of the didactic lecture has been depreciated, the dissecting-room is far more important

Froebel has influenced the pedagogics of medicine as well as the education of the child "We learn by doing" is the spirit which permeates our instruction in anatomy So is it that the Anatomical Laboratory has become the centre around which our anatomical education revolves Everything else is subsidiary

The Anatomical Laboratory has been dignified not alone by its educational importance, but by the atmosphere which pervades it Here the student is taught cleanliness, the use of rubber gloves Here is inculcated the habit of observation, examination, description Not alone is the student required to dissect, he must draw important regions, model in clay the brain, the

bones, and joints, write descriptive essays concerning surgical landmarks

The aim is not alone to dissect the part, but to make this the medium through which are moulded methods of thought invaluable in the practice of medicine

The student must *see* for himself, and not rely upon what he is told to see Individual effort makes strong men

This is the trend of thought and the evident purpose of Professor Barker's book The text is excellent, the illustrations ample, the nomenclature modern, the index complete We congratulate the author in presenting to the profession a thoroughly modern work

We commend the book to those who wish to possess a *modern* Laboratory Manual of Anatomy

WILLIAM FRANCIS CAMPBELL

THE CLINICAL STUDY OF BLOOD-PRESSURE A Guide to the Use of the Sphygmomanometer, etc By THEODORE C JANEWAY, M D, Lecturer on Medical Diagnosis, University and Bellevue Hospital Medical College, and Visiting Physician to the City Hospital, New York City 8vo, pp 300 New York and London D Appleton & Co, 1904

Any means by which bedside observation may be rendered more exact cannot but be welcomed by the progressive clinician The old method of estimating blood-pressure variations by means of the "educated touch" is not without value, but has probably had its day, and is even now giving way to the more exact manometric method, which, in the form of the modern sphygmomanometer is clinically applicable The importance of carefully recording the variations in blood-pressure which occur during the course of disease has long been recognized, and the numerous observations, made chiefly by physiologists and pharmacologists, on the lower animals show how interdependent blood-pressure changes and other bodily phenomena are

Unlike the sphygmograph, the sphygmomanometer has evidently come to stay, the physical principles upon which its construction is based being sound, and its clinical practicability having been established. A book, therefore, containing a clear and concise presentation of the principles of construction, the methods of use, the advantages and defects, and the chief data thus far obtained by means of the several forms of sphygmomanometer now available for office and bedside use,—such a book, in fact, as this one by Dr Janeway,—should not only be welcomed by the medical profession, but should, and in all likelihood will, stimulate those of its members who are really interested in the improvement of clinical methods to the further investigation of the value of blood-pressure records as a means towards more exact diagnosis and prognosis, and more successful treatment.

The book is evidently the work of a cautious and painstaking investigator, one who is deeply interested in the subject, who values fact more highly than theory, who is as fully conscious of the limitations as of the advantages of the method he employs, and who is well versed in the literature of the subject.

JOHN C CARDWELL

## CORRESPONDENCE.

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### CARGILE MEMBRANE

EDITOR ANNALS OF SURGERY

IN the ANNALS OF SURGERY for June, 1905, Dr Albert B Craig and Dr Aller G Ellis present a report upon experiments with Cargile membrane for the purpose of preventing peritoneal adhesions in dogs. The experiments also included work with nerves and tendons.

The authors believe that the membrane is not of service in preventing the formation of peritoneal adhesions. My own experiments were performed upon rabbits, and the reason why I took up the work was because of the beneficial effect of the membrane in two cases in which it was used for preventing recurrence of adhesions in patients.

The result of the experiments upon rabbits was definite enough to make me continue to use the resource in peritoneal work in my practice, and a conclusion would naturally be that in rabbits and in man the effect of the presence of the membrane in the peritoneal cavity is different from the effect in dogs. The peritoneums of different animals act very differently in response to irritants. Since my original report was published, I have had opportunity to learn of the practical value of the membrane in three cases in which the abdomen was reopened in patients several months after the primary application of the membrane. In one case in which I had separated very extensive bile-tract adhesions and applied the membrane, there was no recurrence of adhesion over the area covered by the membrane, but there were new distant adhesions. In a case in which I had separated very extensive adhesions following a pelvic peritonitis, and had applied the membrane, the patient returned for continued adhe-



sion irritation, and was able to locate definitely the points of new adhesion. About two-thirds of the area that had been covered with membrane remained free from adhesions, and the remaining third was in about the same condition as at the first operation, with firm, new adhesions. These were separated and more membrane applied, and the patient states that since the last operation she is entirely free from adhesion irritation. Her general gain in health and in appearance bears out the statement. In a third case in which I separated very extensive adhesions following appendicitis, the patient returned because of continued adhesion irritation. More than half of the area that had been covered with the membrane was free from adhesions, and the remaining half was as bad as before. Membrane was reapplied, and since that time the patient states that she is distinctly better, but feels that there are still points of adhesion. Her relief from adhesions has been so progressive, though not complete, that she wishes a third operation. When a patient returns for a third operation of the same sort, it is a fair presumption that the patient has noted well the effect of the former operations.

A number of patients for whom I have separated adhesions and have applied the membrane have made a satisfactory response. It is still a question in my mind if the Cargile membrane method is superior to the aristol film method, but each has its place, and both are satisfactory to the extent that I must use them continually in my own practice. There are cases in which one must operate more than once, however, but so long as he can count progress the procedure may fairly be classed as desirable surgery. I have one patient upon whom I have operated eight times, employing the aristol film method. The case was one of general peritonitis following a perforative sigmoiditis. Several feet of bowel were freed from adhesions at each operation, and at the last operation the bowel was so free from adhesions that no more work is contemplated.

ROBERT T. MORRIS, M.D.

NEW YORK, June 17, 1905

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### HAMAMELIS

#### ITS THERAPEUTIC USES AND THE POISON PERILS OF ITS ADULTERATION

In an address delivered April 26, 1905, before the Danbury Medical Society, on "The Practical Value of Old Remedies," John V. Shoemaker, M.D., LL.D., of the Medico-Chirurgical College, Philadelphia, Pa., spoke of witch-hazel, or hamamelis, in the following terms:

"Witch-hazel, or *Hamamelis Virginiana*, an excellent old-time remedy, has a well-defined range of usefulness within which it is without a rival. Externally and internally it is sedative and astringent. It is used as a lotion and ointment in many diseases and injuries of the skin, in leg-ulcer and varicose veins. It is serviceable in acute and chronic diarrhoea, internal hemorrhages, bronchorrhoea, epistaxis, varicose veins and varicocele.

"The distilled extract of hamamelis is a valuable application to sprains and bruises. Hamamelis is very useful in checking epistaxis, bleeding sockets after the extraction of teeth, bleeding hemorrhoids and many other forms of hemorrhage. An ointment containing witch-hazel is of service in burns, eczema, erysipelas, sunburn, seborrhoea, acne, etc. A diluted fluid extract of hamamelis makes an effective lotion in hyperidrosis. A witch-hazel lotion or ointment is an excellent application in fissure of the anus. When given internally this remedy exerts the same astringent and sedative action and is highly valued in the treatment of acute and chronic diarrhoea, dysentery, hemorrhage from internal organs, purpura hemor-

rhagica, varicose veins and ulcers and varicocele."

Pond's Extract of *Hamamelis Virginiana* (as the plant is botanically described by Shoemaker, or *V. virginica*, according to Coston) has been relieving pain and performing other beneficent functions, in the conditions indicated by Shoemaker, for the past sixty years. While it has been imitated and substituted in every conceivable form during this extended period, it stands out to day all the more efficient and esteemed by such comparison, and, in addition to its superlative medicinal properties and action, is a positive guarantee to physician and patient alike against any and all of the poison perils of the common commercial witch-hazels so vividly portrayed by Buller, Wood, Darlington, Lloyd, Hare, Gamble, *London Lancet*, *Journal of the American Medical Association*, *Medical News*, *Medical Record*, *Therapeutic Gazette*, *Boston Medical and Surgical Journal*, *Druggists' Circular*, *Bulletin of Pharmacy*, *Western Druggist*, and numerous other medical writers and professional publications of equal standing and authority.

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## WHAT SHALL IT BE?

This question is present in the mind of the busy physician every summer when he confronts the problem of appropriate tonic medication for the weak, poorly-nourished and debilitated

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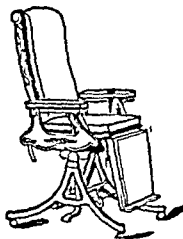
## LOCAL ANALGESIA

Captain J W Houghton, in the *Journal of the Royal Army Medical Corps*, for April, 1905, states that in view of the growing timidity in the use of general anaesthesia for operations, and the magnification of the functions of the anaesthetist, a few remarks on a method of local analgesia may be of interest. Although cocaine and the various freezing mixtures have been found useful to obviate pain in minor operations, yet their uses are restricted and utility limited. The local analgesia which has recently been brought to the notice of surgeons in England by Mr A E Barker, of University College Hospital, is produced by B. eucaïne, a chemical compound, occurring as a white crystalline powder of low toxicity and readily soluble in water. The injection of this in dilute solution, beneath the epidermis, causes complete analgesia of the parts infiltrated, which effect lasts about twenty minutes

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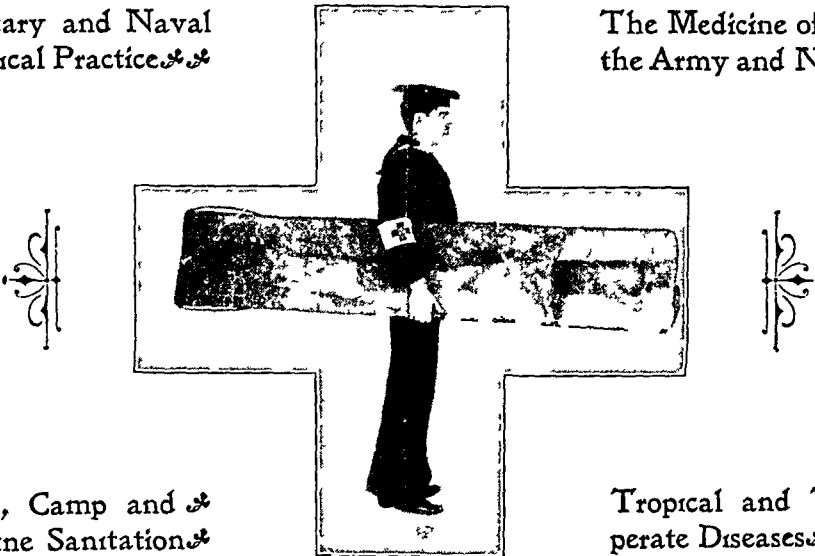
EDITED BY

James Evelyn Pilcher, M.D., Ph.D., L.H.D.,

Major and Brigade Surgeon of United States Volunteers,  
Captain, Retired, in the United States Army

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a A cylindrical glass-wool filter was prepared, and on it was placed a layer of Acetozone crystals, about 3 cm thick. A bouillon suspension of typhoid bacilli passed once through this filter yielded a sterile filtrate, while control tubes gave the usual abundant growth.

b A liter of tap-water was sterilized by heat and, when cool, a suspension of cholera or typhoid germs was added, the experiment being repeated several times. Ten to twenty milligrams ( $\frac{1}{10}$  to  $\frac{1}{5}$  grain) of Acetozone was added and, after thorough shaking, portions of the liquid were taken out and planted in bouillon and agar which was plated. In each instance the cholera germs were destroyed completely in five minutes, and the typhoid germs in fifteen minutes by the extremely small quantity of Acetozone used. It should be observed that the addition of 10 mg of Acetozone to 1 liter of water represents a solution of 1 part to 100,000. Controls gave abundant growths, the plates yielding 600,000 to 800,000 colonies.



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Benzo-kinone has been successfully tested in comparative trials with creosote, carbolic acid, guaiacol and derivatives of that class, in pulmonary tuberculosis, catarrhal troubles, bronchitis and many stomach and intestinal diseases, where antiseptic action by increasing the activity of the phagocytes is desired. It is better tolerated even in large doses, than any other of this large class of new remedies.

Benzo-kinone is rapidly taken up by the blood and carried by the circulation to the pulmonary lesions, thus maintaining conditions which inhibit further tubercular degeneration of lung tissue. The urine soon shows its presence when tested with perchloride of iron, and the same test will show that its antiseptic action is continuous in the intestines.

Tuberculosis of the lungs is one of the most difficult diseases to arrest, because the bacillus which forms the toxic ptomaines that sap the patient's vitality, is surrounded by an impregnable wall of connective tissue that shuts off all approach of the blood current and hinders the action of the phagocytes, it is found that with this agent it is possible to so saturate the blood, that the antiseptic conditions once well established, prevent further autoinfection. This process once arrested, the purulent and effete matter is expelled by expectoration or absorbed in a comparatively aseptic condition, the existing lesions heal, while the causes of the fever, night-sweats, cough and pain being removed, a healthy disposition to gain flesh is induced.

## IN CEREBRO-SPINAL MENINGITIS THE DIPLOCOCCUS INTRACELLULARIS

oftentimes finds entrance to the meninges from its primary habitat in the mucous membrane of the nose.

Dr E K Dunham, of the Meningitis Commission (N Y), declares that "any inflammation of the nose and throat might furnish an avenue for the germ."

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MARION T DAVIS, M D,

Univ. of Maryland School of Medicine  
Atlanta, Ga., April 15, 1905



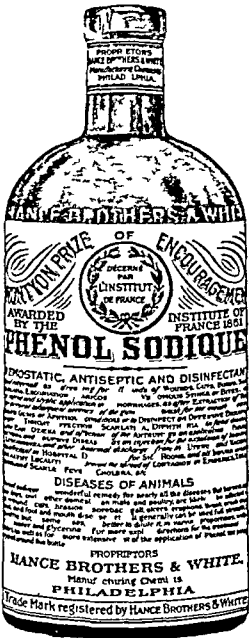
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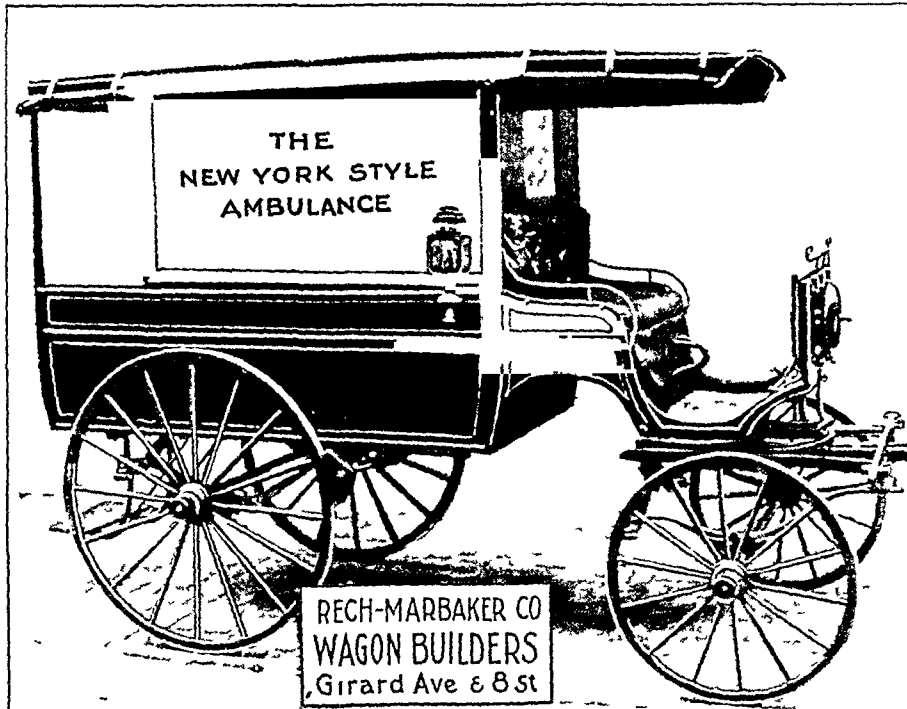
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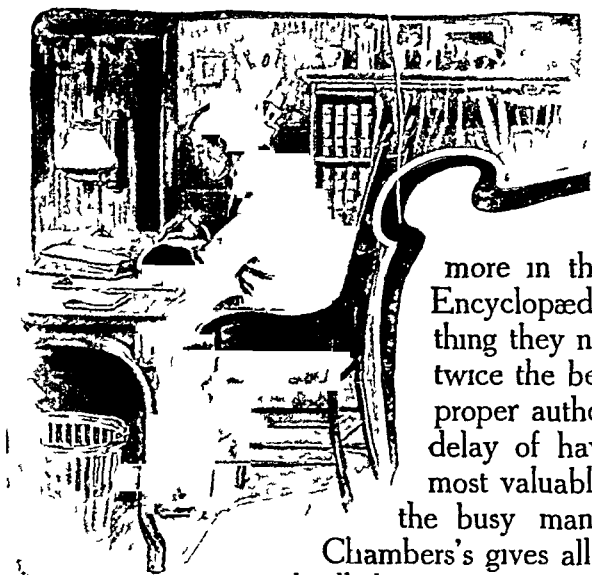
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